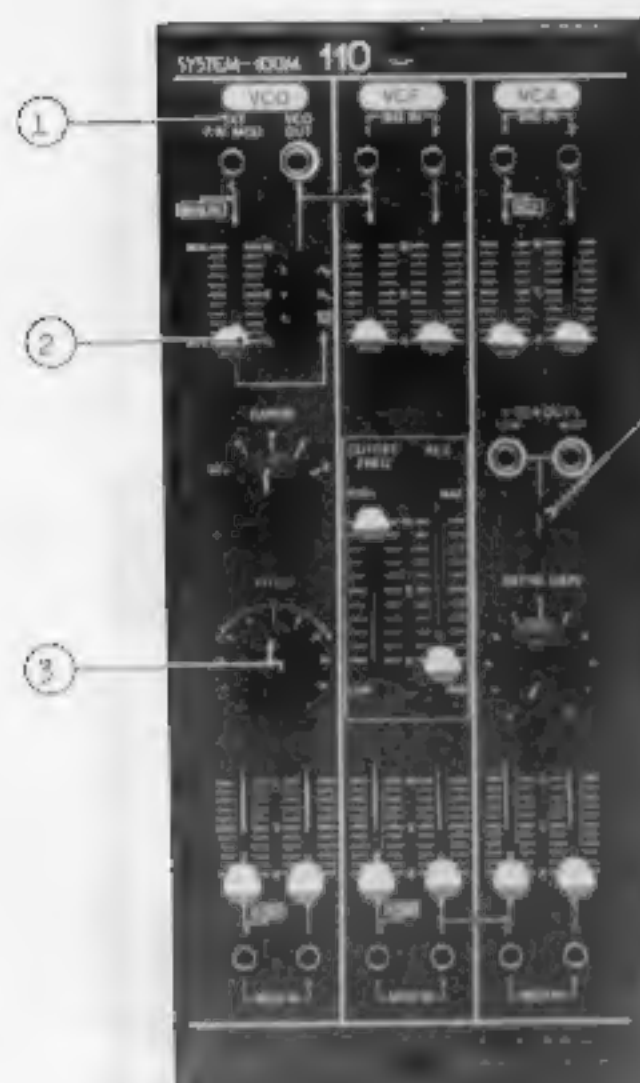


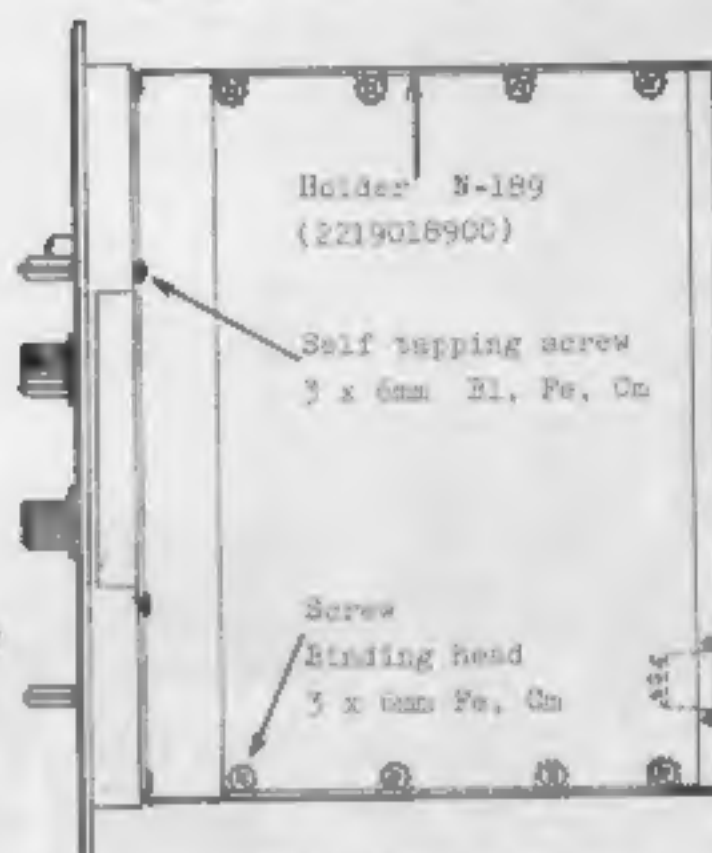
SYSTEM 100M SERVICE NOTES

First Edition



Pictures on this page represent parts common to modules and similarities.

For ①-④, see list at the right.



Cover N-122 (2201012200) Binding head 3 x 6mm Fe

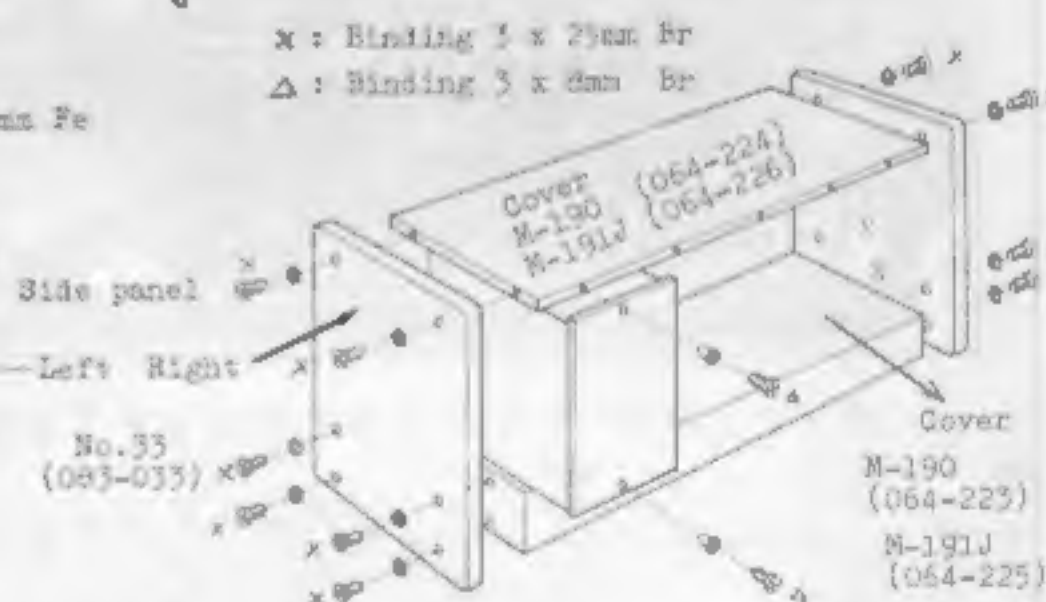


Twin pin jack
P-254P-4
(009-016)

DIN socket 6P
CS0690-1-1
(13429603)

Chassis

M-190: No.222 (061-222)
M-191J: No.221 (061-221)



DIN socket 6P CS-660-1-1 (009-036)

Jack HLJ-102-104 (13449111)

LED
LRC601R
(019-020)

M-191J

-M-191J only



Jack SJ409-1-2 (13449402)

Panel M-190: No.231 (072-231)

M-191J: No.234 (072-234)

M-1	
①	M-1 22210 19300
②	K 13
③	K 3
④	G L 1

Jack 30
(009-016)

Knob No
Pot.
VM10RKL
(028-7)

Switch
SLE-623
(131391)

Pot.
VM10RKL
(028-7)

Cabinet

Jack
DIN



PB-4

Power
SDG5E
SDG5E
SDG5E

Parts are designated in New numbering (8-10 digits) and/or Old (6 digits).

"N" heading abbreviated new number stands for NEW.

When ordering replacement, use "No." for only old one.

Each figure, 0-13, at lower line in (2) - (4) indicates part per module.

	M-110	M-112	M-121	M-130	M-131	M-132	M-140	M-150	M-172	M-182
(1)	N-193 22210-19300	N-195 22210-19500	N-197 22210-19700	N-198 22210-19800	N-199 22210-19900	N-200 22210-20000	N-201 22210-20100	N-203 22210-20300	N-204 22210-20400	N-205 22210-20500
(2)	K n o b 13	N o . 10	7 9 16	0 1 6 - 0 7 9 12	2 2 4 7 0 1 2 9 0 0 4	N - 1 2 9 10				
(3)	K n o b 3	N o . 4	7 8 0	0 1 6 - 0 7 8 2	2 2 4 7 0 1 2 8 0 0 1	N - 1 2 8 1				
(4)	G L - 3 A R - 1 (red) 1	(0 1 9 - 0 2 2) 0	1 5 0 2 9 1 1 0 2	GL-3AR-2 (red) 2	0 1 9 - 0 2 0 3	1 5 0 2 9 1 0 9 2				
	G L - 3 P G - 1 (green) (019-023) 1	15029111 0								

Jack SG-8050#4
(009-007)

Knob No.44 (016-044)
Pot.
VM10RK15B15(L)
(028-727)

Switch
SLE-623-12P(S)
(13139131)

Pot.
VM10RK15A26(L)
(028-756)

Removal screws
Top cover: 3.1 x 10mm wood, RH, Br
Cabinet (side): 3 x 25mm binding, Br
Cabinet (bottom): 4 x 15mm truss, Br

Top cover No.205 (065-205)

Cabinet No.122
(081-122)

Endblock No.242
(072-242)

Keyboard SK-132E
(004H006)

KEY ASSEMBLY
F (IVORY) (108-015)
G (IVORY) (108-016)
A (IVORY) (108-017)
B (IVORY) (108-018)
C (IVORY) (108-019)
D (IVORY) (108-020)
E (IVORY) (108-021)
F (IVORY) (108-022)
SHARP (BLACK) (108-023)

M-180

Base No.20 (foot)
(111-020)

Cabinet No.155 (081-155)

Panel No.241
(072-241)

Jack HLJ-102-1-4 (13449111)
DIN socket OS-660-1-1 6P (012-036)

Top cover No.206
(065-206)

M-181



Keyboard SK-192B (004H007)

Panel No.233 (072-233)

Switch SLE-622-12P(S) (13139130)

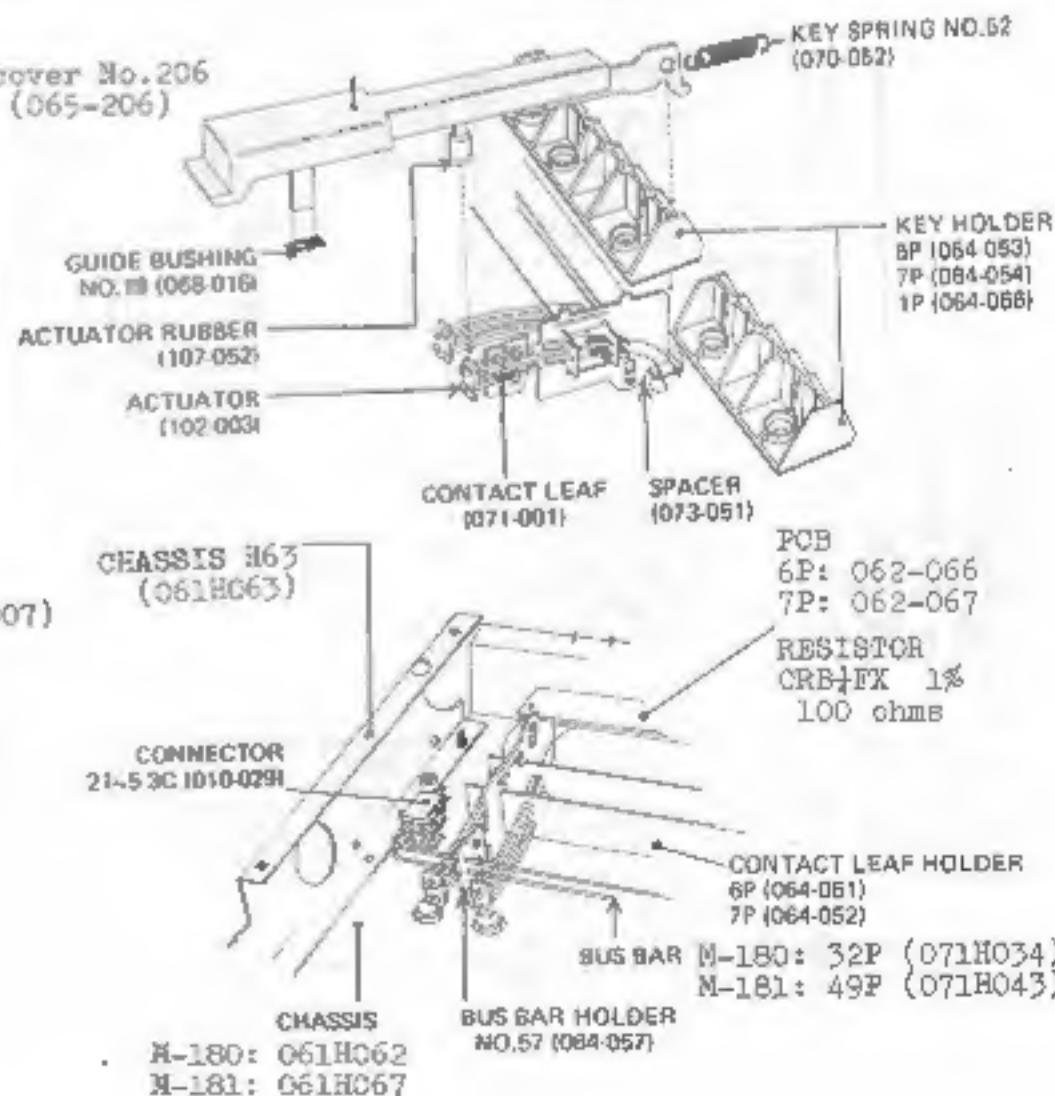
PB-4 (029-022)

Power switch

SDG5P-001-1 (13129101) 100V

SDG5P-001-2 (13129102) 117V

SDG5P-502 (13129103) 220/240V



OP9101-030 (P/N 7910103000)
(pcb 052-403-1)

M-110

OP9101-040 (Part number 7910104000)
(pcb 052-403-2)

NOMENCLATURE	PART NO.	MANUFACTURE NAME
J- 1-16	13449402	EJ-409-1-2
SK- 1	13119401	GRM025152
SK- 2	13159304	GBB02334
VB- 1, 2, 13, 14, 21, 22	13339301	EVA-HO4015A13
VB- 3, 20	13219200	VMI0KB100 A20 100KH
VB- 4, 15, 16, 23, 24	13339304	EVA-HO4015B13
VB- 5	13299501	PSB22H101H
VB- 6	13299508	PSB22H503H
VB- 7	13299504	PSB22H502H
VB- 8	13299542	SH19K 4.2KH
VB- 9, 20	13299114	SH19K 10KH
VB- 10, 19, 26, 27	13299117	SH19K 100KH
VB- 11	13299115	SH19K 12KH
VB- 12	13299507	PSB22H503H
VB- 17	13339402	EVA-HO4015B13
VB- 18	13339401	EVA-HO4015A13
S- 1, 2	2019910600	Holder S-106
CS- 1, 2	13439506	JOY4-02H
IC- 1, 3, 4, 7	15189109	QPC4556C
IC- 8	15219101	QA726H
IC- 4, 5	15189118	T10870C
IC- 6, 9, 10, 11	15229803	DA663-A
IC- 12	15229803	DA663-B
IC- 13	15189109	QA701H
Q- 1, 3, 4, 17, 18, 17, 18	15119112	78A1019-Y
Q- 5	15139110	8P510
Q- 5, 6, 11, 12, 13, 14, 10, 21, 22	15129111	28Q1015-Y
Q- 7, 9, 9, 10, 14	15139103	3SE30ATN-0R
D- 1, 2, 4, 5, 6, 7	15019103	182473
D- 3	15019423	182453 power
C- 2	1506911770	CG0901H220V-Y
C- 4, 5, 6, 7	1356911110	CG0901H3710-Y
R- 104 thermistor	15229908	SHI-100C

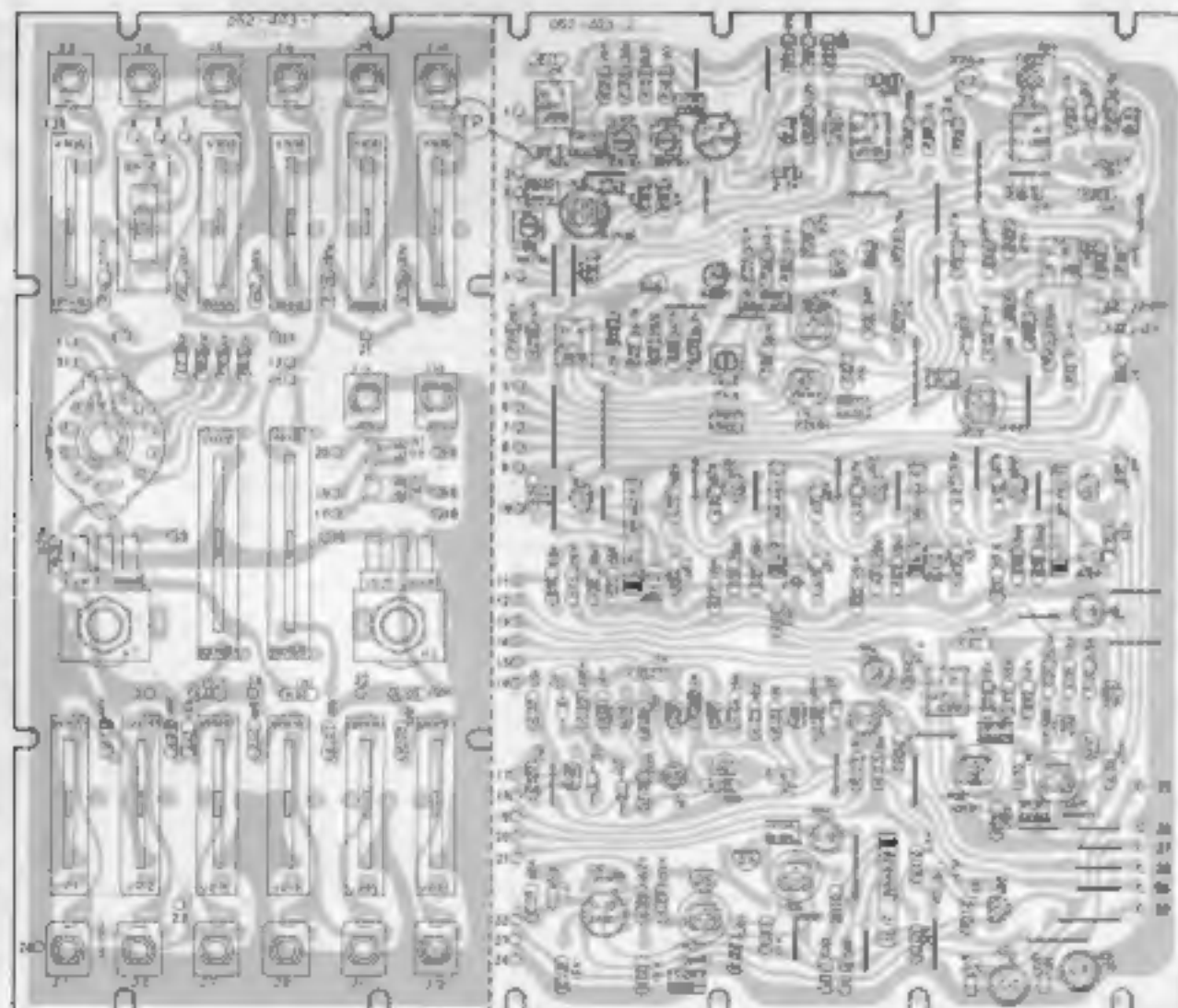
□ CKB 1/4 P2 1%

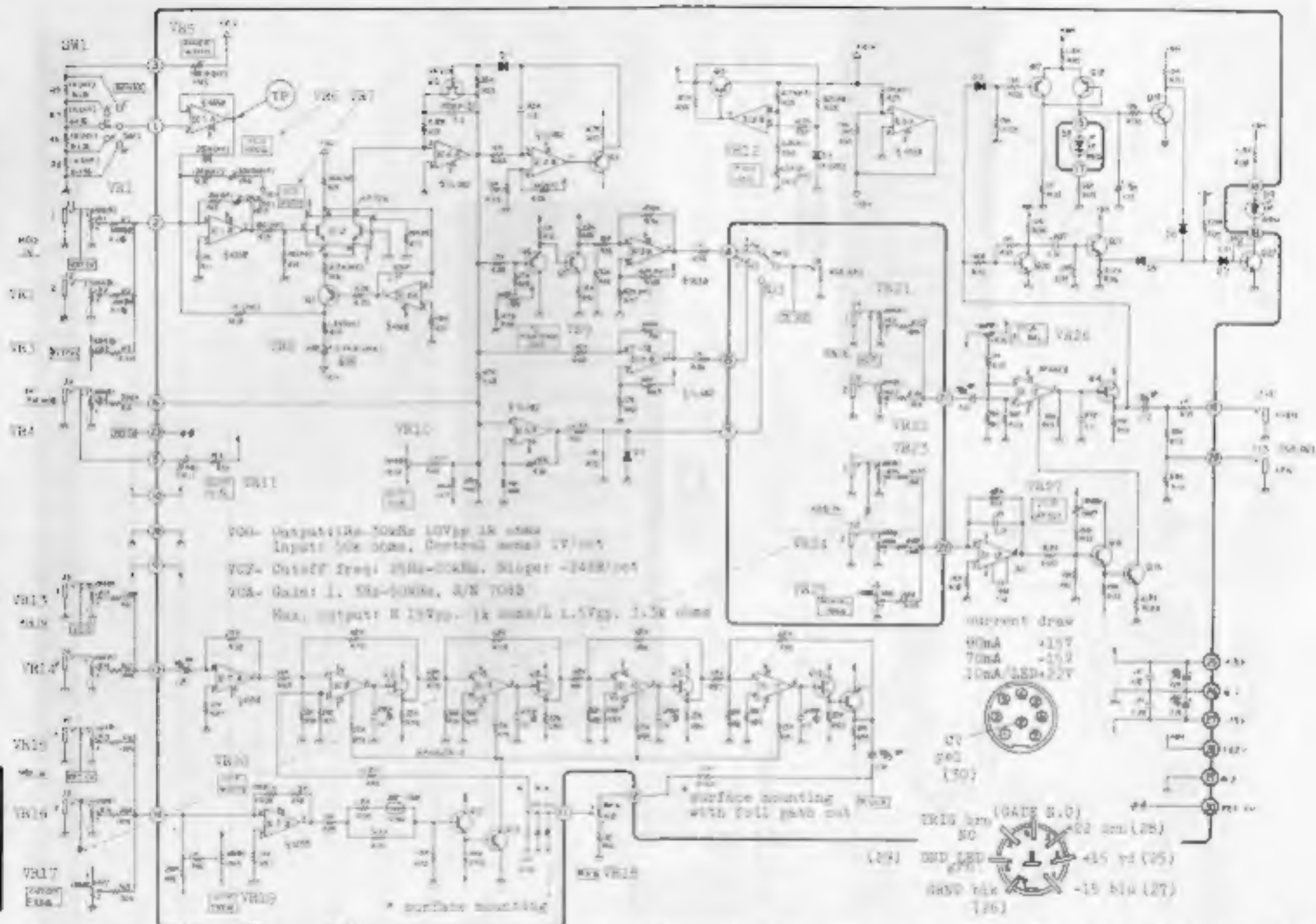
□ ERB 1/4 PX 0.1%

○ polystyrene

○ bi-polar

○ tantalum





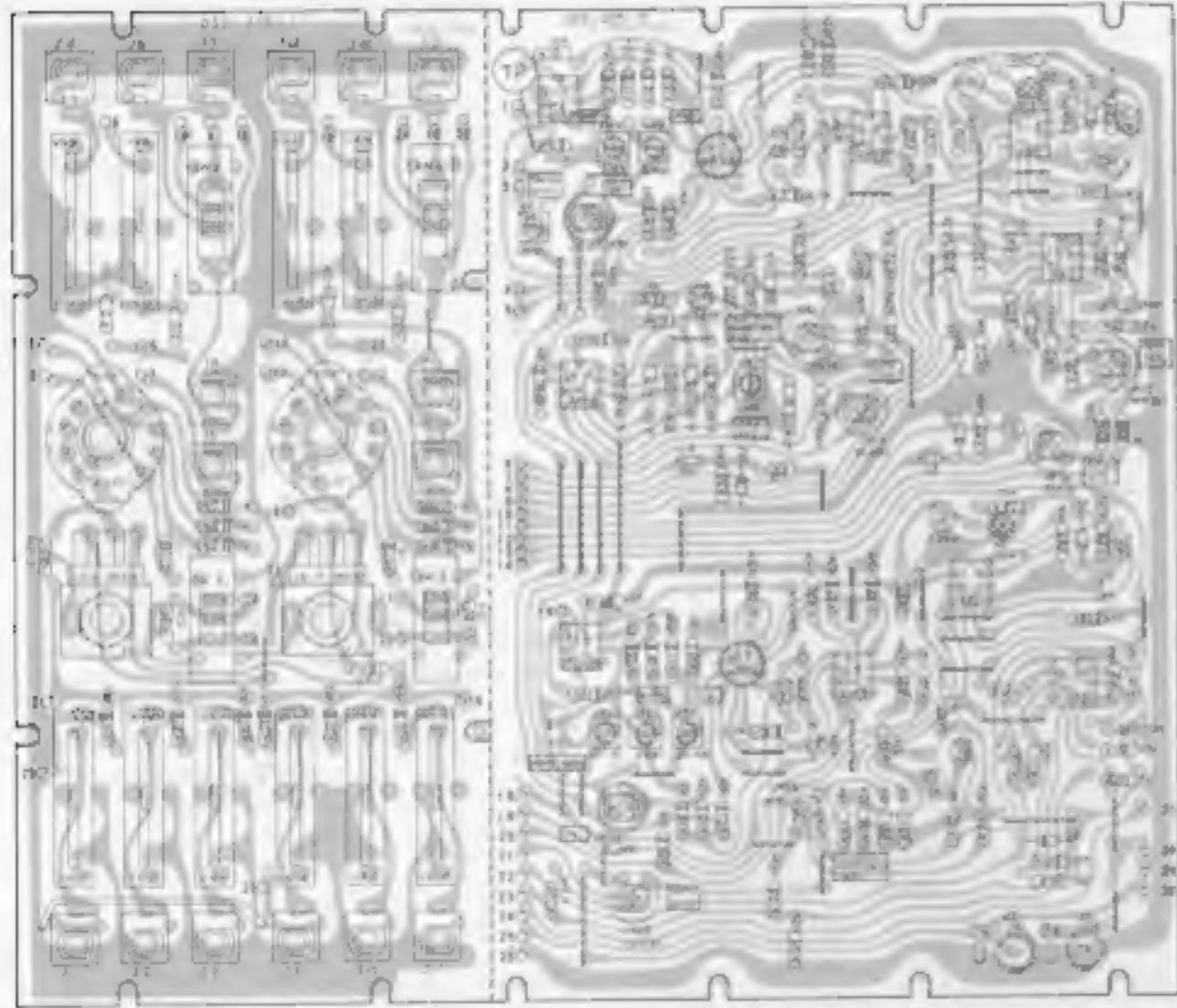
OP9102-030 (P/N 7910203000)
(pcb 052-405-1)

M-112

OP9102-040 (Part number 7910204000)
(pcb 052-405-2)

VDD output: 1k, 10V p-p
Input: 50k

Freq.: 18u-30kHz
Control: Serial 19-out



REFERENCE	PART NO.	PART NAME
1-	1-26	13449402 BJ-409-1-2
2-	1, 4	13119401 SRM-1025172
3-	2, 5	13159103 BSB-02242
4-	5, 6	15159304 BSB-02335
VR-	1-3, 14-16	13339301 EVA-BU4C15A15
VR-	4, 17	13219220 VM10KB100 LOCKB
VR-	1, 4, 18, 19	13339304 EVA-HU4C15A15
VR-	3, 20	13299501 PMB2-2H101H
VR-	6, 21	13299508 PMB2-2H503H
VR-	6, 22	13299504 PMB2-2H202H
VR-	10, 23	13299542 CR19K 1, 2KR
VR-	21, 24	13299114 BR19K 10KB
VR-	12, 25	13299117 BR19K 100KB
VR-	13, 26	13299115 BR19K 22KB
VR-	27	13299507 PMB2-2H502H
1-	1, 2	2219510600 Holder M-106
10-	1, 3, 4, 8, 11	14109105 WPC4558C
10-	2, 7	15219101 MAT26H0
10-	4, 5, 9, 10	15169118 TLO82
4-	1, 3, 4, 7, 8, 11	15119112 TBA1015-2
4-	6, 8	15139110 WFS10
4-	4, 6, 10, 12, 13	15129113 TBC1015-2
1-	1, 2, 3, 4, 5, 6	15019103 1U2475
1-	7	15019525 1U2453
1-	21, 2	1756911720 CQ0931H2220-V polyethylene

total film
GRS 1/475 0.3% 20C-
total film
GRS 1/475 1% 20A-

TOP VIEW



WPC4558C
NJM4558
TLO82CP
BP INPUT
JFET INPUT



OP9103-030 (P/N 7910303000)
(pcb 052-407-1)

M-121

OP9103-040 (Part number 791030400)
(pcb 052-407-2)

μA726 M-110 M-112

The transistor pair is held at a constant temperature by active temperature regulator circuitry.

ABSOLUTE MAXIMUM RATINGS

Operating Temperature Range
0 to 100°C

Supply Voltage . . . 15V

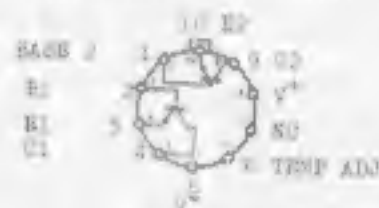
Internal Dissipation . . . 300mW

Collector to Emitter Voltage . . 90V

Collector to Base Voltage . . . 40V

Emitter to Base Voltage . . . 5V

Collector Current 1mA



NOMENCLATURE	PART NO.	PART NAME
J- 1-16	13449402	BJ-409-1-2
SW- 1, 2	13159903	HQPH24-12P
VR- 1-3, 11-15	13335301	EVA-H04-C15A15
VR- 4-6, 14-18	13339304	EVA-H04-C15B15
VR- 7, 17	13339402	EVA-T04-C15B15
VR- 8, 16	13339401	EVA-T04-C15A15
VR- 9, 18	13299117	SR-19R 100K
VR- 10, 20	13299114	SR-19R 100K
DR- 1, 2, 7, 8	13439502	3024-020
DI- 1, 6	13109108	APC459BC
IC- 1, 3, 4, 5, 7-10	13229802	HA62-A
Q- 1-4, 14-17	13239101	2SC30ATW-SS
Q- 5, 6, 10-13	13129113	2SC1819-Y
Q- 7-9, 20-22	13119112	2SA1015-Y
J- 1-4, 7-10	13019103	1B2473
C- 5-8, 16-19	13549121F0	CQ09S1H471G-V
R- 10, 106	13229908	3DT-1000
C- 1, 3, 15, 20	13609910	2CH-A25B10

NOMENCLATURE	PART NO.	PART NAME
J- 1-16	13449402	6J-409-1-2
JW- 1, 2	13159103	SSE-022-42
VR- 1-3, 11-13	13339301	BYA-H04-C15A15 100KA
VR- 4-6, 14-16	13339304	BYA-H04-C15B15 100KB
VR- 7, 17	13219220	UM10BB10CK20 100KB
VR- 8, 10, 18, 20	13299117	SR19H 100KB trimmer
VR- 9, 19	13299115	SR19H 22K2
CR- 1-4	13499502	X024-02C
IO- 1, 2	15229803	DA662-B
IO- 3	15189105	GPC4558C
Q- 1, 12	15159103	2SE304EN-GB PBT
Q- 2, 4, 8-11	15129115	2SC1815-Y
Q- 3, 5-7	15119112	2SA1015-Y
D- 1-4, 7-10	15019103	1S2475
C- 10mfd/25V	13639932	Bi-polar ECB-A25M (19)

TC4001BP

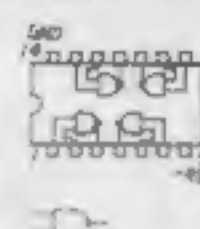
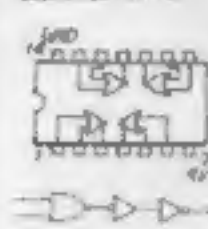
TC4011UBP

ME404 TIMER

VCC

Quad 3-Input NOR Gate

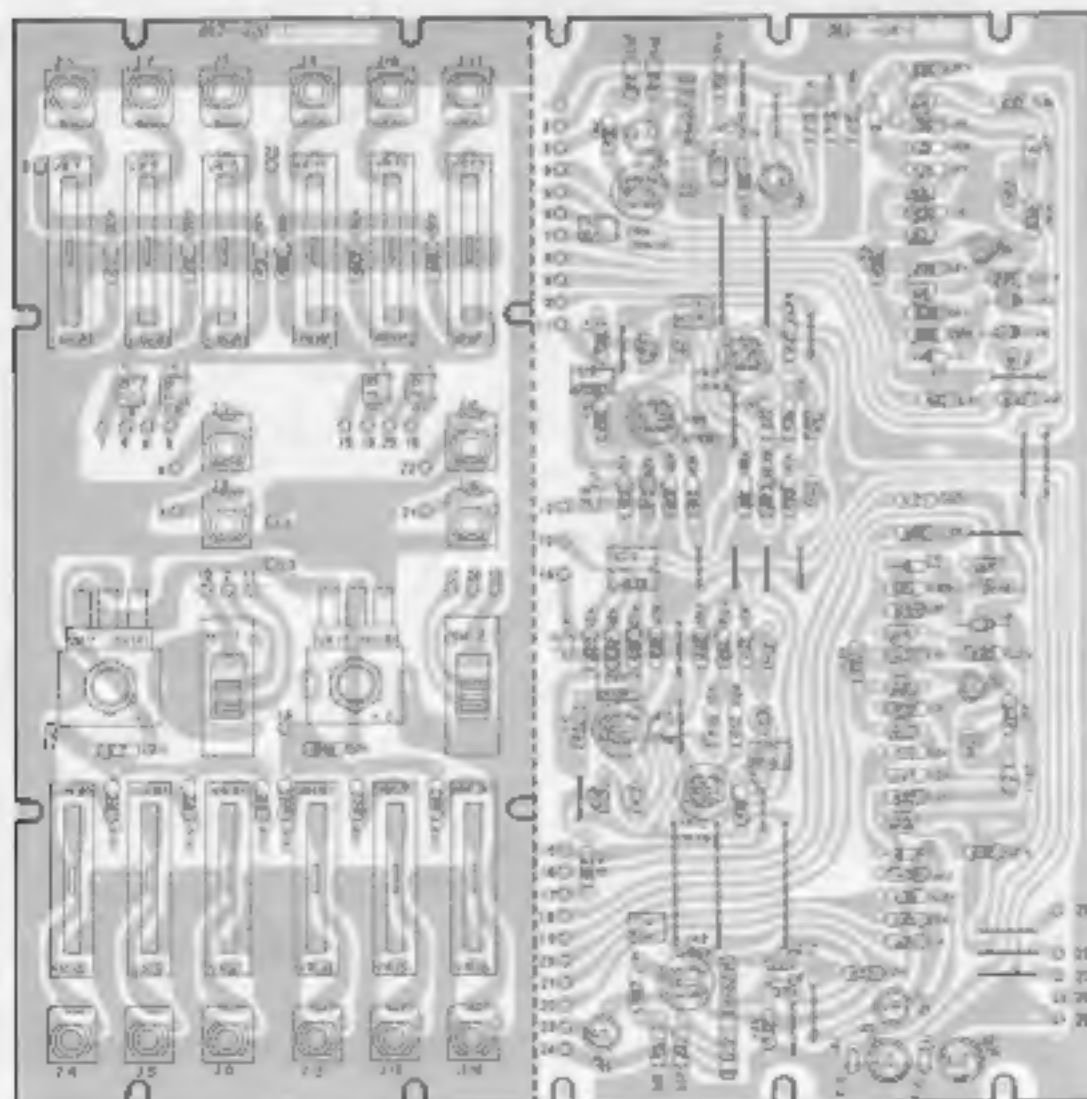
Quad 3-Input NAND Gate

THRESH (1)
HOLD

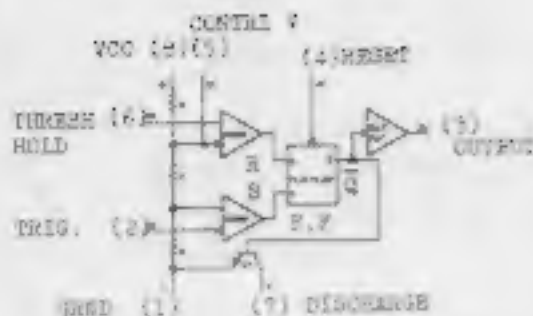
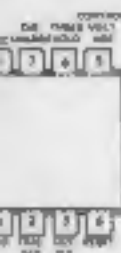
TRIG. (2)

Q&Q1

OP9104-030 (P/N 7910403000) **M-130** OP9104-040 (P/N 7910404000)
(pcb 052-408-1) (pcb 052-408-2)



555 TIMER



MC14827B OCTAL COUNTER/DIVIDER

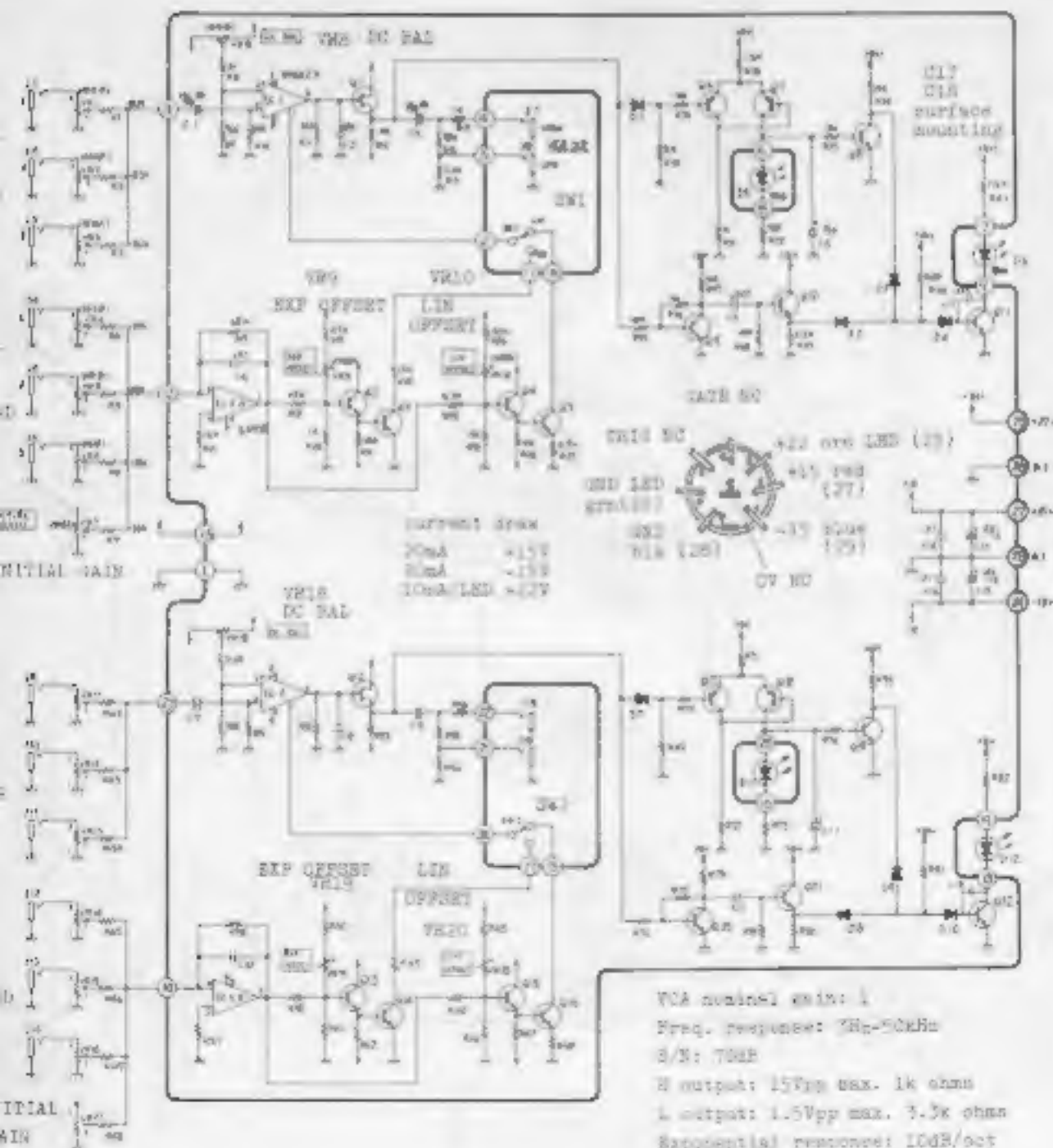
TRUTH TABLE

Four stage Johnson octal (Positive Logic) counter with built-in code converter.




CLK	EN	RST	OUTPUT
0	X	0	n
X	1	0	n
X	0	0	n+1
X	X	0	n
X	X	0	n+1
X	X	0	n
X	X	1	Q0

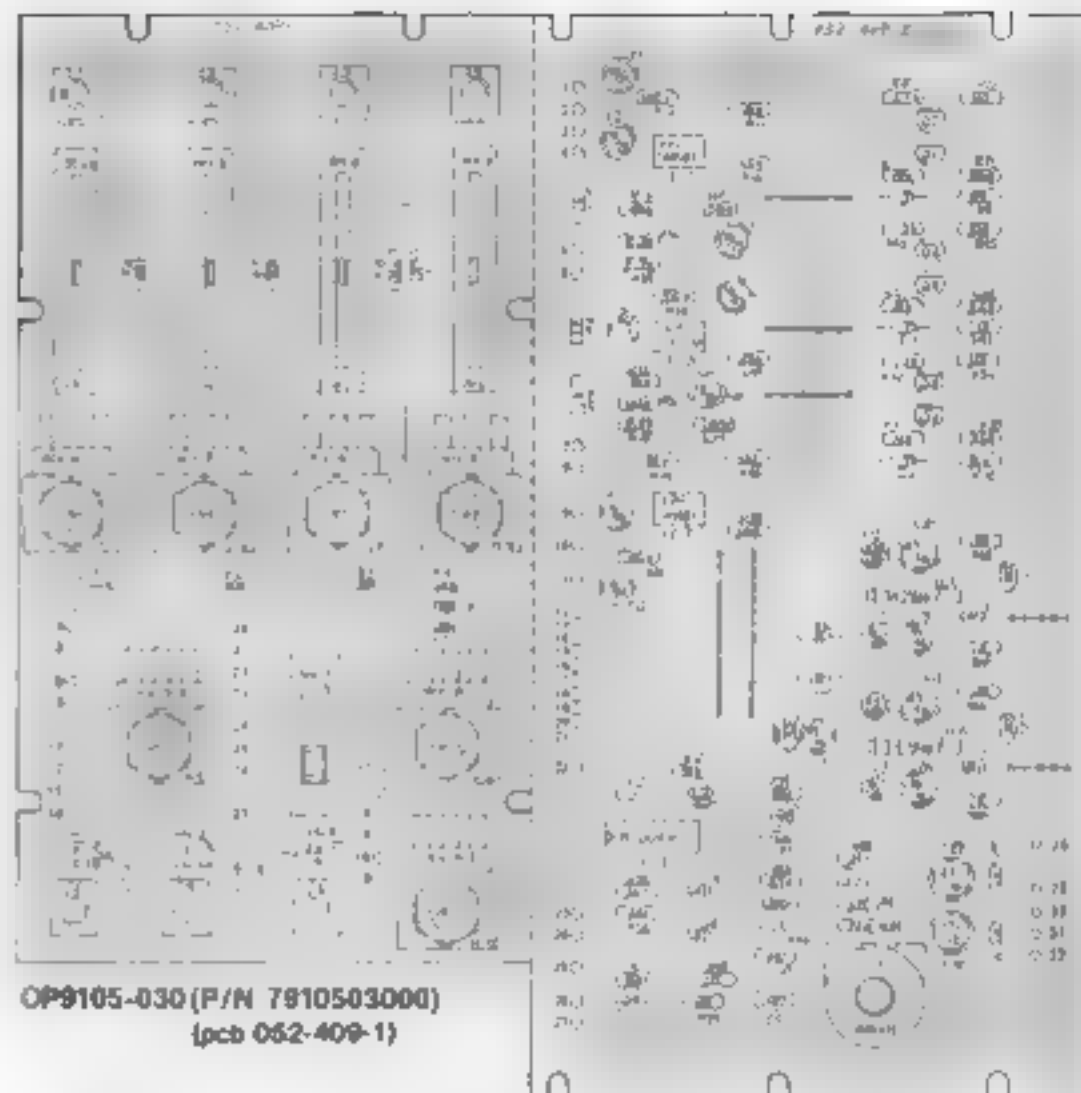
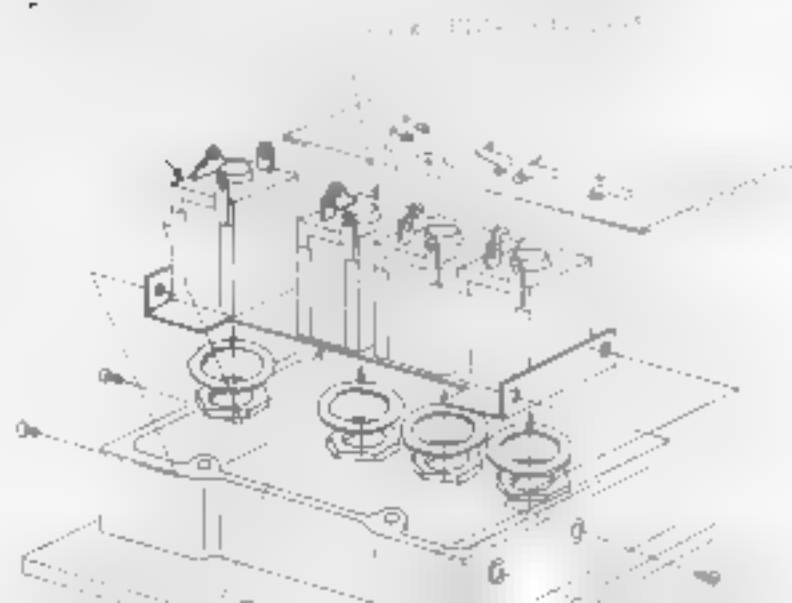
X Don't Care
If n < 4 Carry=1
Otherwise = 0



VCA nominal gain: 1
Freq. response: 20Hz-50kHz
S/N: 70dB
R output: 15Vpp max. 1k ohms
L output: 1.5Vpp max. 3.3k ohms
Sagittal response: 10dB/oct

NOMENCLATURE	PART NO.	PART NAME
J- 3-5, 7-9	13449402	SJ-409-1-2
J- 6, 8, 10	13449115	HLJ-0264-01-010
J- 11	13449114	HLJ-0264-01-020
Ka- 1	13159503	9QPR24-12F
Ur- 1-4	13339402	3VA-TDA-C15B15
Vk- 5-8	13219806	GM7CR910E K20 100K- A/C
Vh- 9, 11	13219807	GM7CR910E K20 100KB A ?
Vr- 10	13219220	VM7CR910C K20 100KB
H- 8	2219019000	Holder S-190
D- 4-6	15029110	OL-JAR-1
IC- 1, 2	15189106	u2045580
IC- 3	15189109	uA701HC
IC- 4	1518910570	TC4013BP
IC- 5, 6	15199502	TAT066AP
Q- 1-6	15119112	23A1025-Y
Q- 7-9	15129113	23C1015-1
R- 1-3	15019103	182471
L- 1	2244021200	Coil XC3MV 400mH
D-  Bipolar	1563993270	ECRA2-W10 (Data/25V

Jack HLJ-0264-01-020



M-131

OP9105-040 (P/N 7910504000)
(pcb 052-409-2)

TA7D66P

Charge Amp (CA)
Low Noise Amplifier

Manufactured Under Patent No. 2,740,142

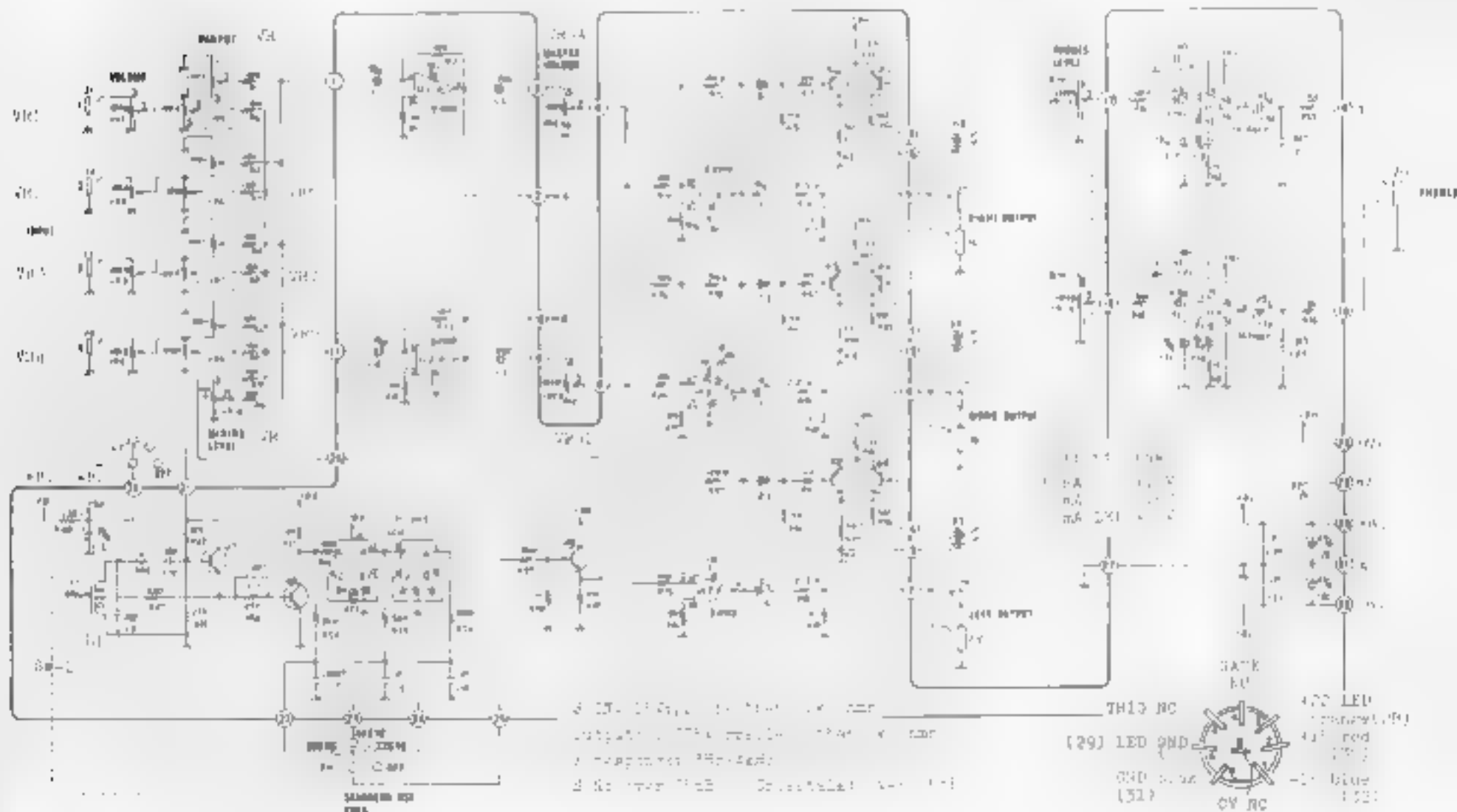




1. *Journal of the American Medical Association*, 1997; 277: 103-107.
 2. *Journal of the American Medical Association*, 1997; 277: 108-112.



1. The first step is to identify the problem or goal. This involves understanding the current situation and what needs to be achieved.

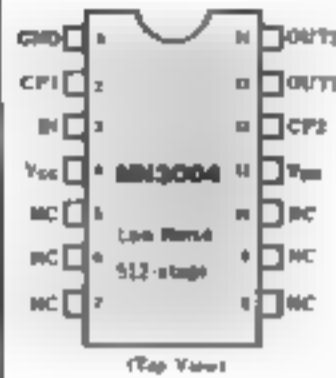


DEC. 15, 1980

5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

NOMENCLATURE	PART NO.	PART NAME
J-	1-18	13449402 SJ-409-1-2
VR-	1-8	13339304 EVA-H04C15B15
VR-	9, 10	13339402 EVA-TOAC15B15
VR-	11,12	13299544 CR19R 22KB

IC-	1-4	15189105 uPC4558C
Q-	1-4	15119112 2SA1015-Y
D-	1-4	15019103 1S2473
C-		13639149JO BCE-A16V47 47/16V



BBD

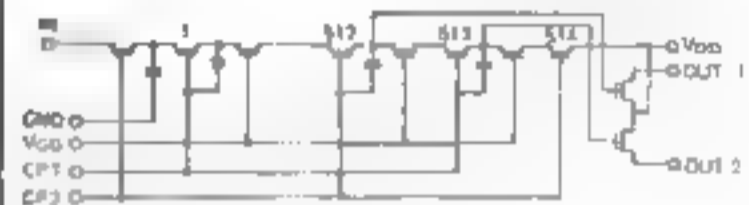
Signal Delay Time
2.56ms-25.6ms

S/N 85dB typ

VDD -15V
VGG -14V

THD 0.4%

+SIG IN
GAIN ADJ
GAIN ADJ
-SIG IN



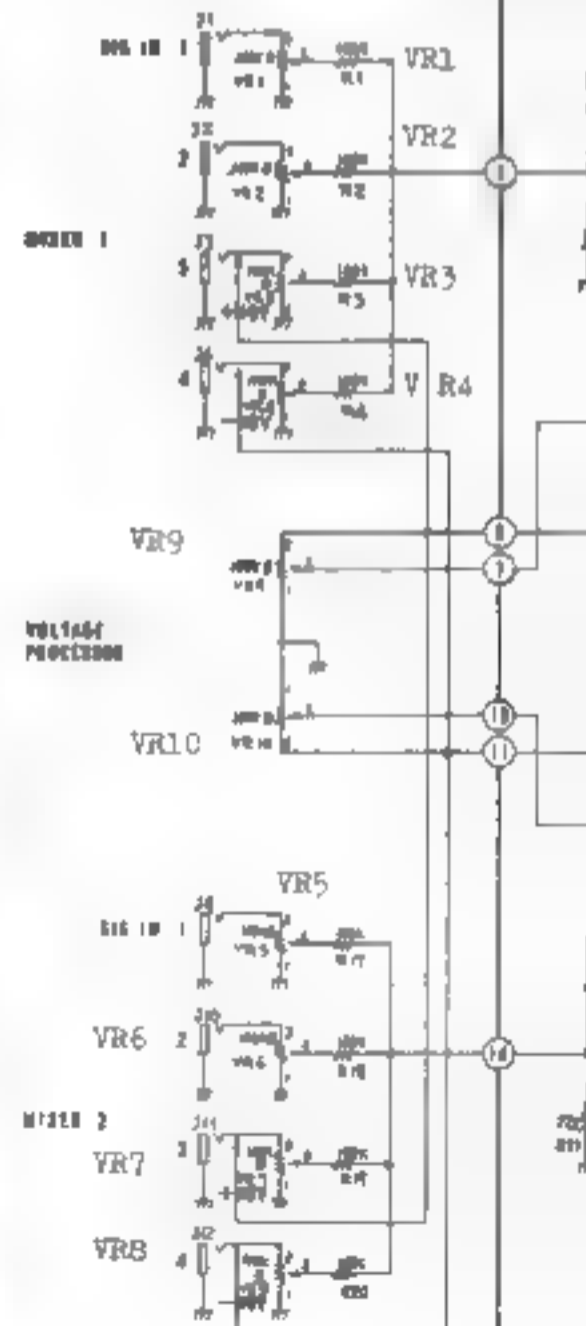
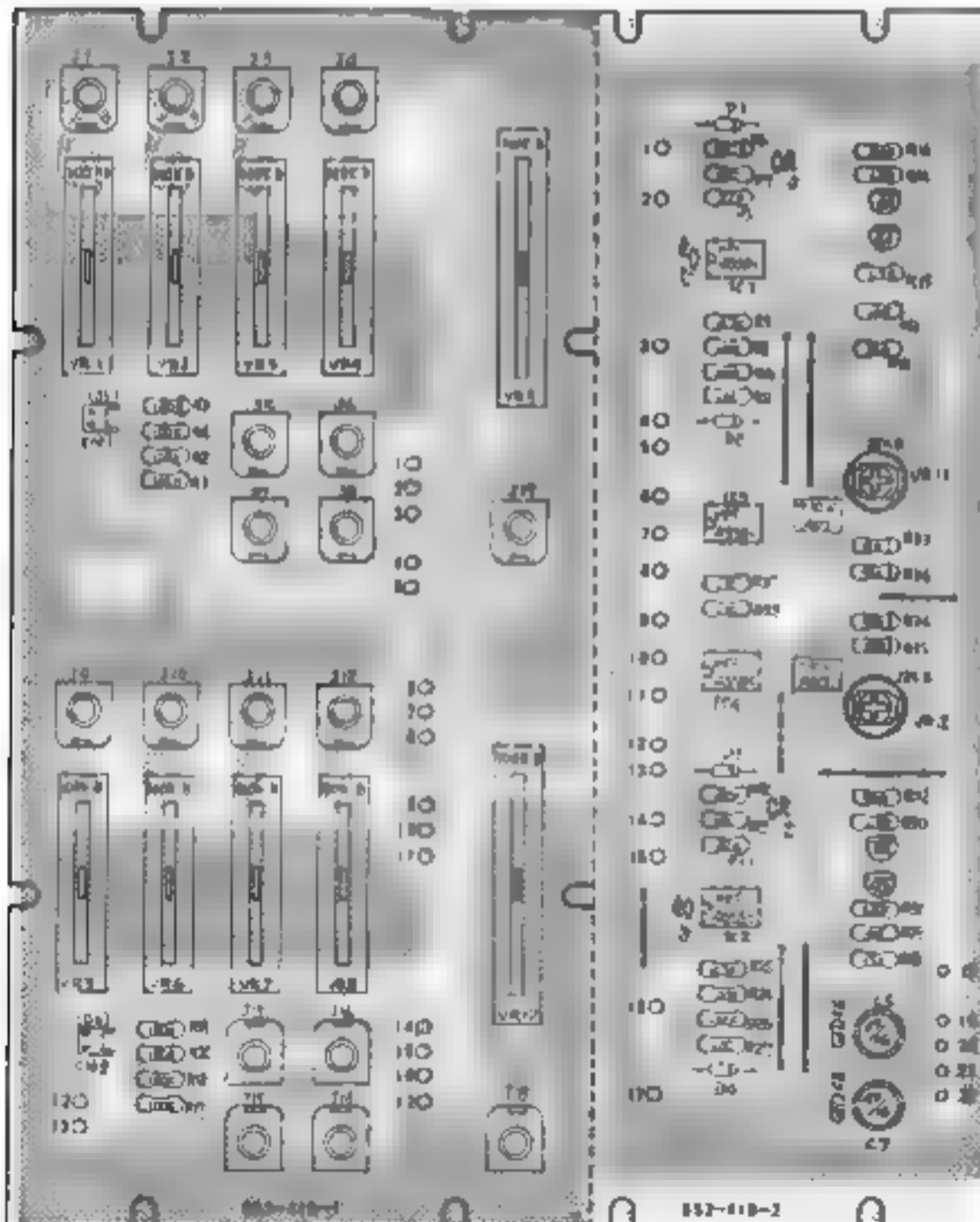
+SIG
GAIN
GAIN
-SIG
BIAS
+OUT

OP9106-030 (P/N 7910603000)
(pcb 052-410-1)

M-132

OP9106-040
(Part Number 7910604000)
(pcb 052-410-2)

Signal input: $\pm 10V_{pp}$ max. 1k oh
Output: $\pm 10V_{pp}$ max. 1k oh
F. response: 10-40kHz



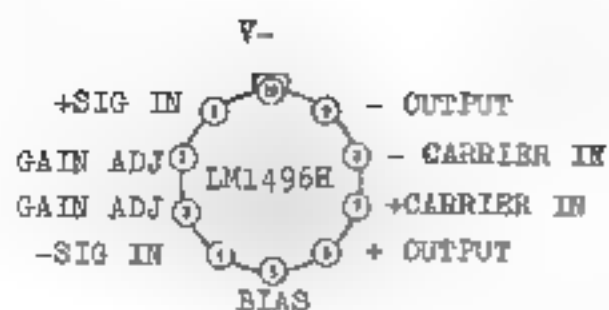
BD

Delay Time
~25.6ms

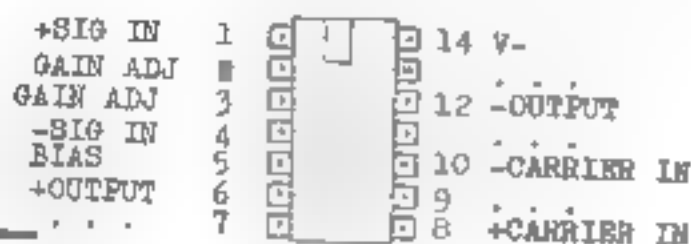
85dB typ

-15V
-14V

0.4%



(Top View)

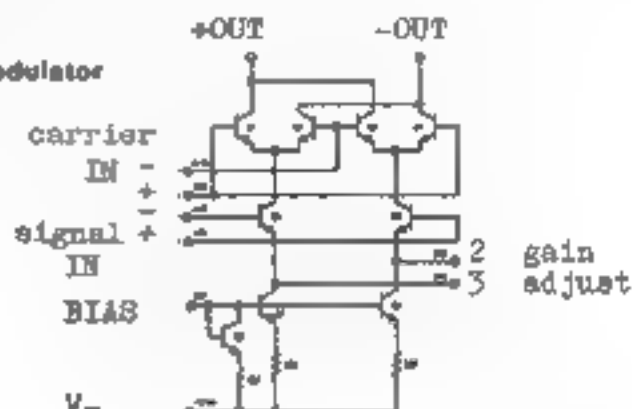


LM1496N

Output voltage is proportional to the product of an input (signal) voltage and a switching (carrier) signal.

Carrier Suppression: 65dB typ. @ 0.5MHz
50dB typ. @ 10MHz

LM1496 balanced modulator-demodulator

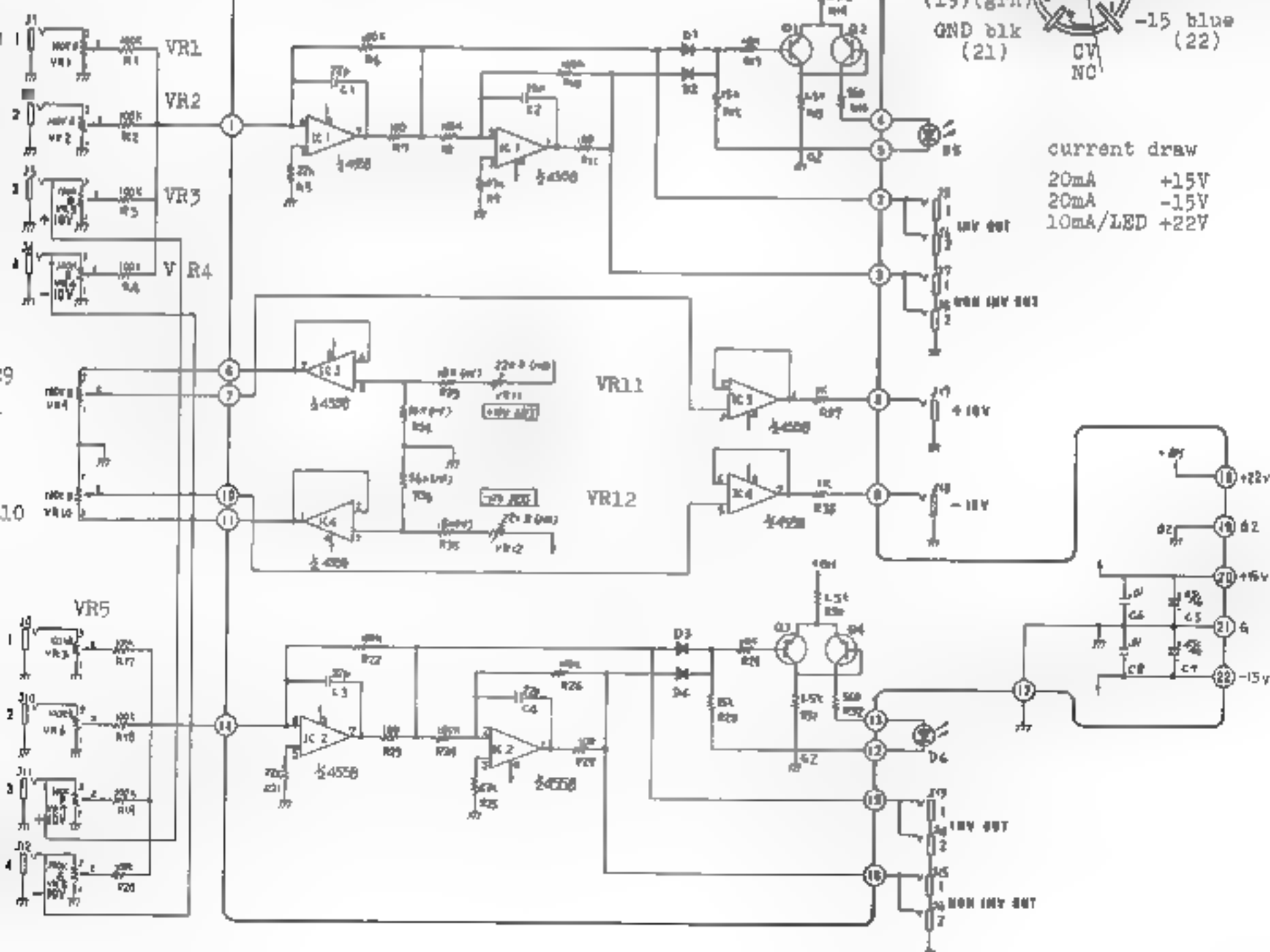


Input: $\pm 10V_{pp}$ max. more than 50k ohms

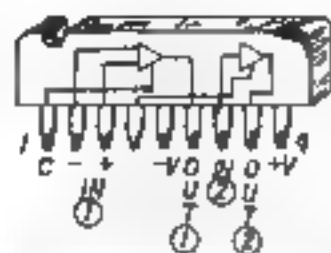
Output: $\pm 10V_{pp}$ max. 1k ohms

Response: DC-40kHz

S/N: over 90dB



BA662 A
BA662 B

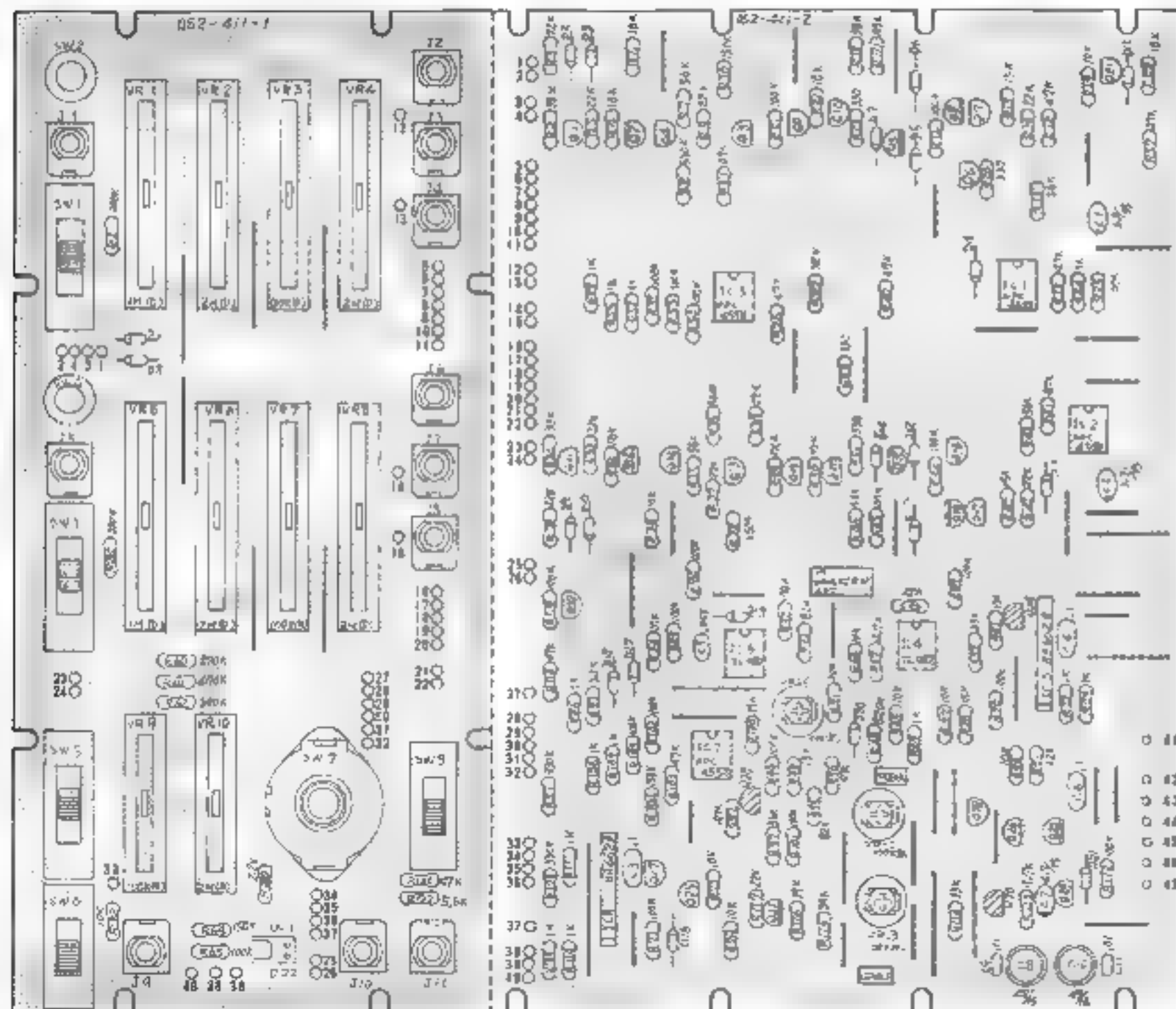


Roland Custom-made DC Controlled Variable Transconductance (gm) Amp.

- Device with an "A" suffix features lower offset coefficients.
- For some particular applications, BA662's are further classified based on "gm" and are painted in a group color. Both BA662 "A" and "B" in the same color are characterized by a "gm" in the range.

Since suffix "A" indicates superior performance, the BA662 "A"s are good alternative for the existing BA662's in the 100W modules.

BA662 "B" can replace only where designation is "B" or "A or B" in circuit diagram or on accompanying list. Device without the suffix will be found on several occasions. Labelling them with suffix is preferable for future reference especially when storing as spare. Also, there might be colored ones, inevitable dependency on IC availability, having no significant meaning in terms of modules' performances, but restoration of more accurate characteristics would be expected if replacement is in the same color. COLOR has GREAT IMPORTANCE in circuits of some MODELS.



NOMENCLATURE	PART NO.	PART NAME
J- 1-11	13449402	SJ-409-1-2
SW- 1, 3, 5	13159304	SSB-02335
SW- 2, 4	13129901	DS-102 rad
SW- 6, 8	13159103	SSB-022-42
SW- 7	13119401	SRM-1026172
VR- 1, 5	13339403	EVA-TOAC15D16
VR- 2, 4, 6, 8	13339404	EVA-TOAC15D26
VR- 3, 7	13339402	EVA-TOAC15D15
VR- 9	13339304	EVA-HO4-C15D15
VR- 10	13339303	EVA-HO4-C15A26
VR- 11, 12, 13	13299117	SR19R 100KB
IC- 1, 2, 3, 7	15189106	GPC4558C
IC- 4, 6	15189118	TLOB2CP
IC- 5, 8	15229803	BA662-B
Q- 1, 3, 4, 6, 7, 9-11, 13, 14, 16, 17, 19-22, 25, 27, 29, 32	15129115	28C1815-Y
Q- 2, 5, 8, 12, 15, 18, 23, 26, 31	15119112	PSA1015-Y
C- 24, 28, 30	15139103	2SE3CATM-GR
D- 1-21	15019103	1S2473
C- 1, 2	13619710FO	3.3mfd/35V tantalum
C- 7	13619711NO	4.7mfd/35V tantalum



OP9107-030 (P/N 7910703000)
(pcb 052-411-1)

M-140

OP9107-040 (Part number 7910704000)
(pcb 052-411-2)

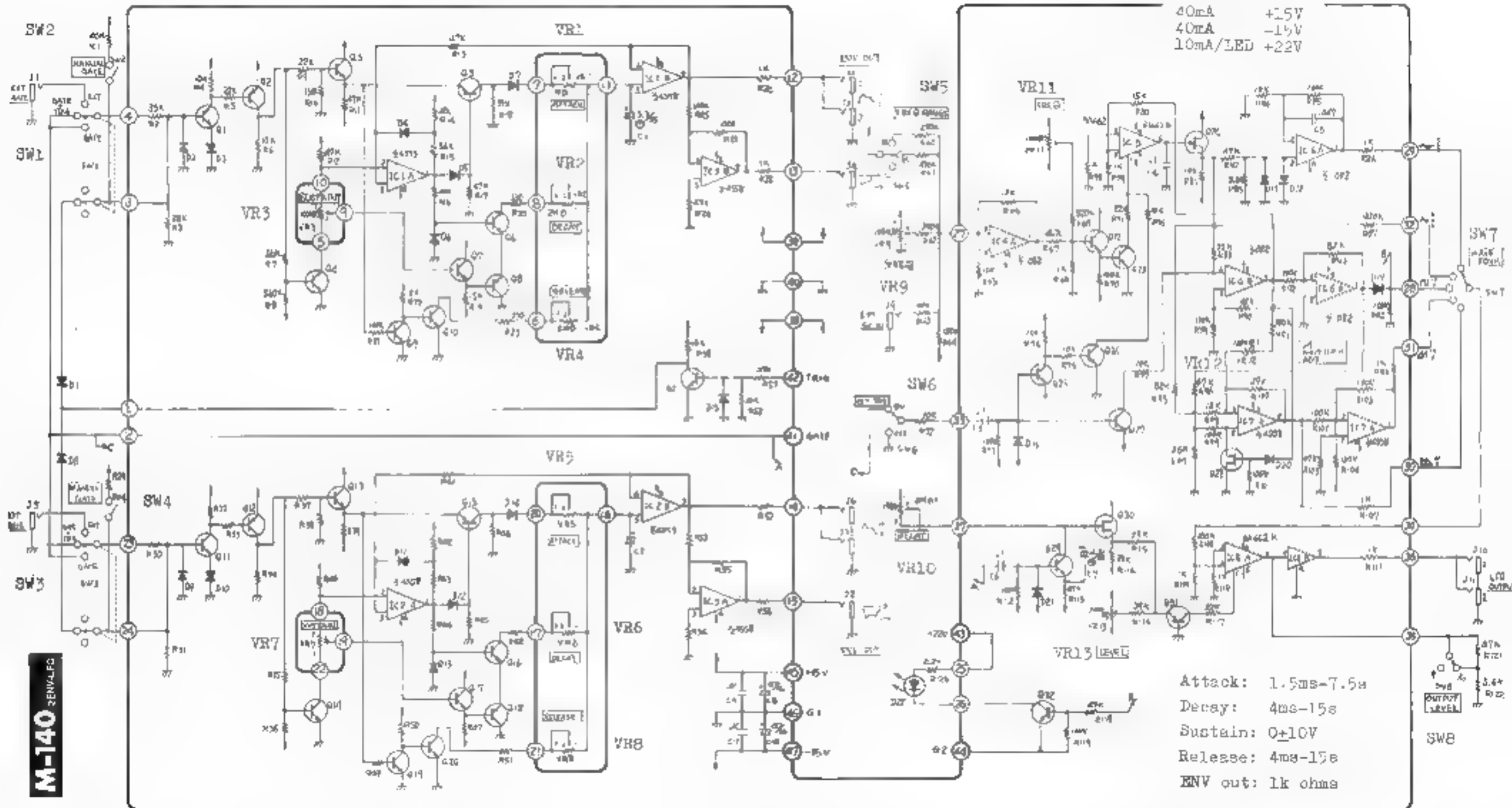
Gate/Trig in: 50k ohms, 3V min.
LFO: 0.05Hz-30Hz
Control sens: 1V/oct

Output: 10Vpp, 1k ohms
Delay time: 0-7s

GATE white(41)
TRIG brn(42)
Gnd LED grn(44)
+22 LED orn(43)
+15 red(45)
-15 blu(47)
Gnd blk(46)

current draw

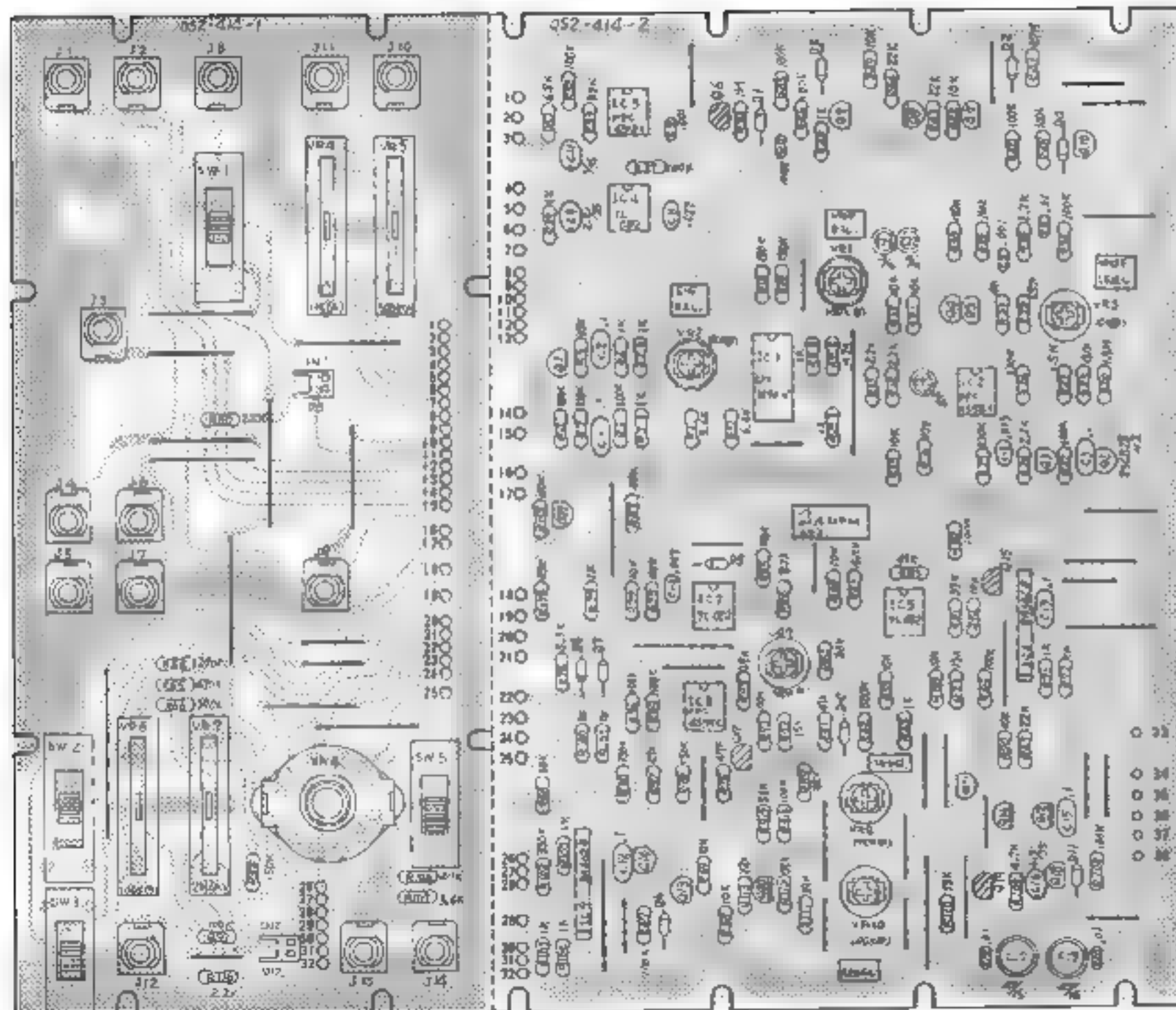
40mA +15V
40mA -15V
10mA/LED +22V



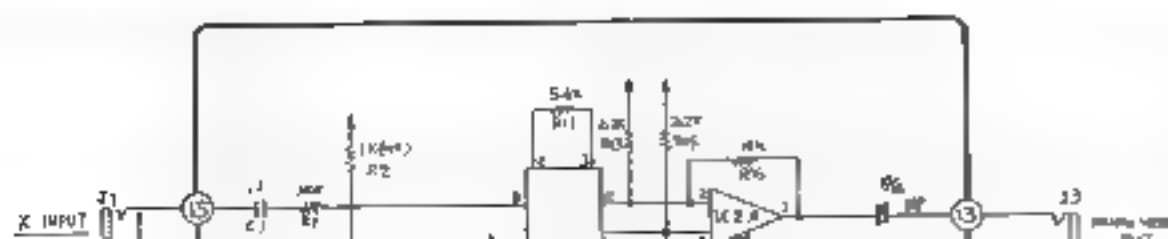
OP9108-030 (P/N 7910803000)
(pcb 052-414-1)

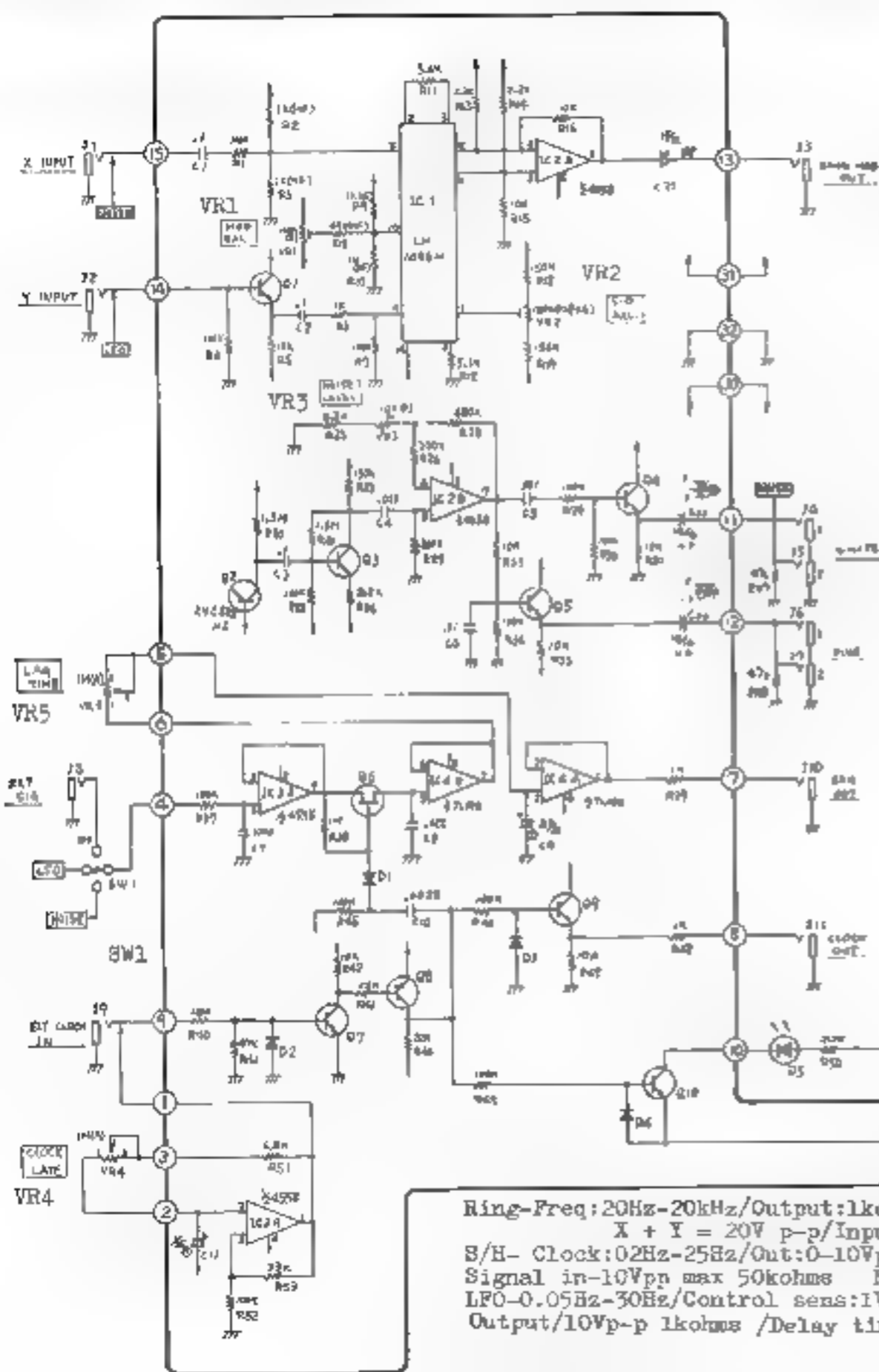
M-150

OP9108-040 (Part number 7910804000)
(pcb 052-414-2)

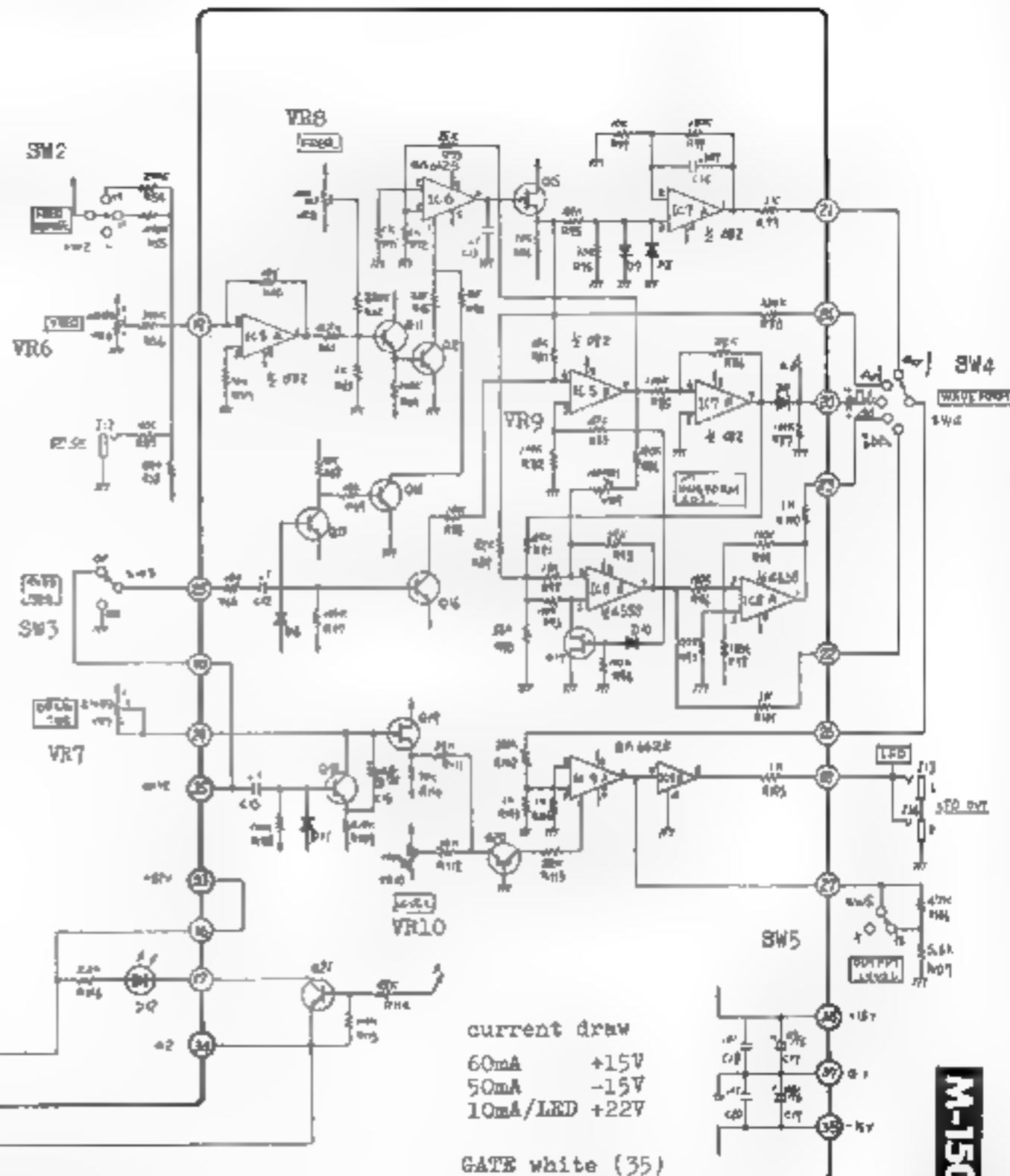


NOMENCLATURE	PART NO.	PART NAME
J- 1-14	13449402	SJ-409-1-2
SW- 1, 2	13159304	SSB-02335
SW- 3, 5	13159103	SSB-02242
SW- 4	13119401	SRM1025172
VR- 1, 2	13299546	GR19R 100KB
VR- 3	13299114	SR19R 10KB
VR- 4	13339302	EVA-H04C15A16
VR- 5	13339305	EVA-H04C15A55
VR- 6	13339304	EVA-H04C15B15
VR- 7	13339303	EVA-H04C15A26
VR- 8, 9, 10	13299117	SR19R 100KB
CH- 1, 2	13439502	3024-020
IC- 1	15219106	LM1496N
IC- 2, 3, 8	15189105	uPC4558C
IC- 4, 5, 7	15189118	TLO82CP
IC- 6, 9	15229803	BA662-B
Q- 1, 3-5, 7 9-11, 13, 16, 18, 21	15129115	2SC1815-Y
Q- 2	151291050A	280828R selected for noise generator
Q- 6, 15, 17 19	15139103	2SK30ATM-GR
Q- 8, 12, 14 20	15119112	2SA1015-Y
D- 1-4, 6-11	15019103	182473
C- 9	13619709NO	2.2mfd/35V
C- 11	13619707NO	1mfd/35V
C- 16	13619711NO	4.7mfd/35V tantalum
C-	13639149JO	ECEA16V47 47mfd/16V
C-	13639922JO	ECEA16N10 bi-polar





Ring-Freq: 20Hz-20kHz/Output: 1kohms/Input: 50k ohms
 X + Y = 20V p-p/Input rejection: 60dB
 S/H- Clock: 0.2Hz-25Hz/Out: 0-10Vp-p max 1k ohms
 Signal in-10Vpp max 50kohms Noise-12Vpp 1k ohms
 LFO-0.05Hz-30Hz/Control sens: 1V/oct
 Output/10Vp-p 1kohms /Delay time: 0-7s



current draw
 60mA +15V
 50mA -15V
 10mA/LED +22V

GATE white (35)

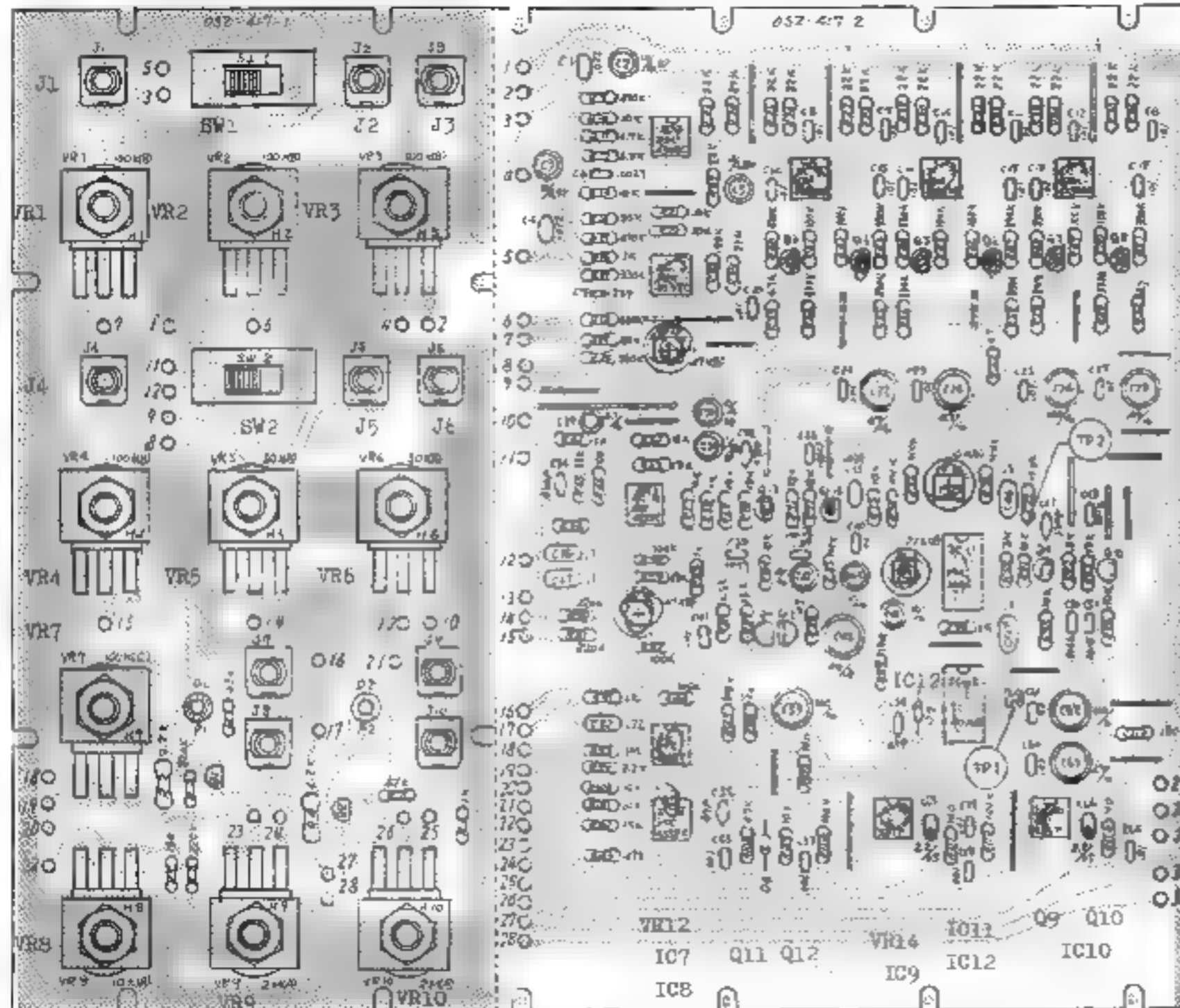
TRIG NC

GND LED
 grn(34)
 GRN blk
 (37)



+22 LED orn(33)
 +15 red
 (36)
 -15 blu(38)

M-150 RING-NOSE SH LFO



OP9109-030 (7910903000)
(pcb 052-417-1)

M-172

OP9109-040 (Part number 7910904000)
(pcb 052-417-2)

PH. SHIFT-200Hz-8kHz/1080/F resp:20Hz-20kHz
S/N:60dB/In:10V.50kohm/Out:less 1kohm
EXTCV:10V max 50kohm/Out:less than 1kohm

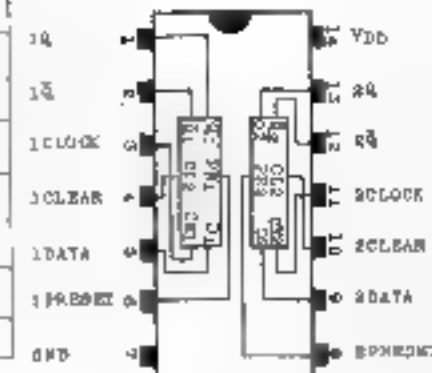
TRUTH TABLE

INPUTS				OUTPUTS	
GL	FR	D	CP	Qn+1	Qn+1
L	H	*	*	H	L
H	L	*	*	L	H
H	H	*	*	L	H
L	L	L	+	L	H
L	L	H	+	H	L
L	L	*	-	Qn	Qn

*: Don't Care
+: No Change

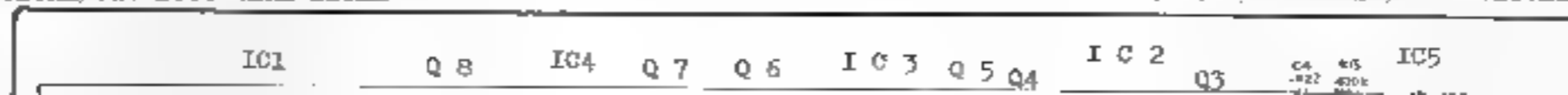
4013B

DUAL TYPE D FLIP-FLOP



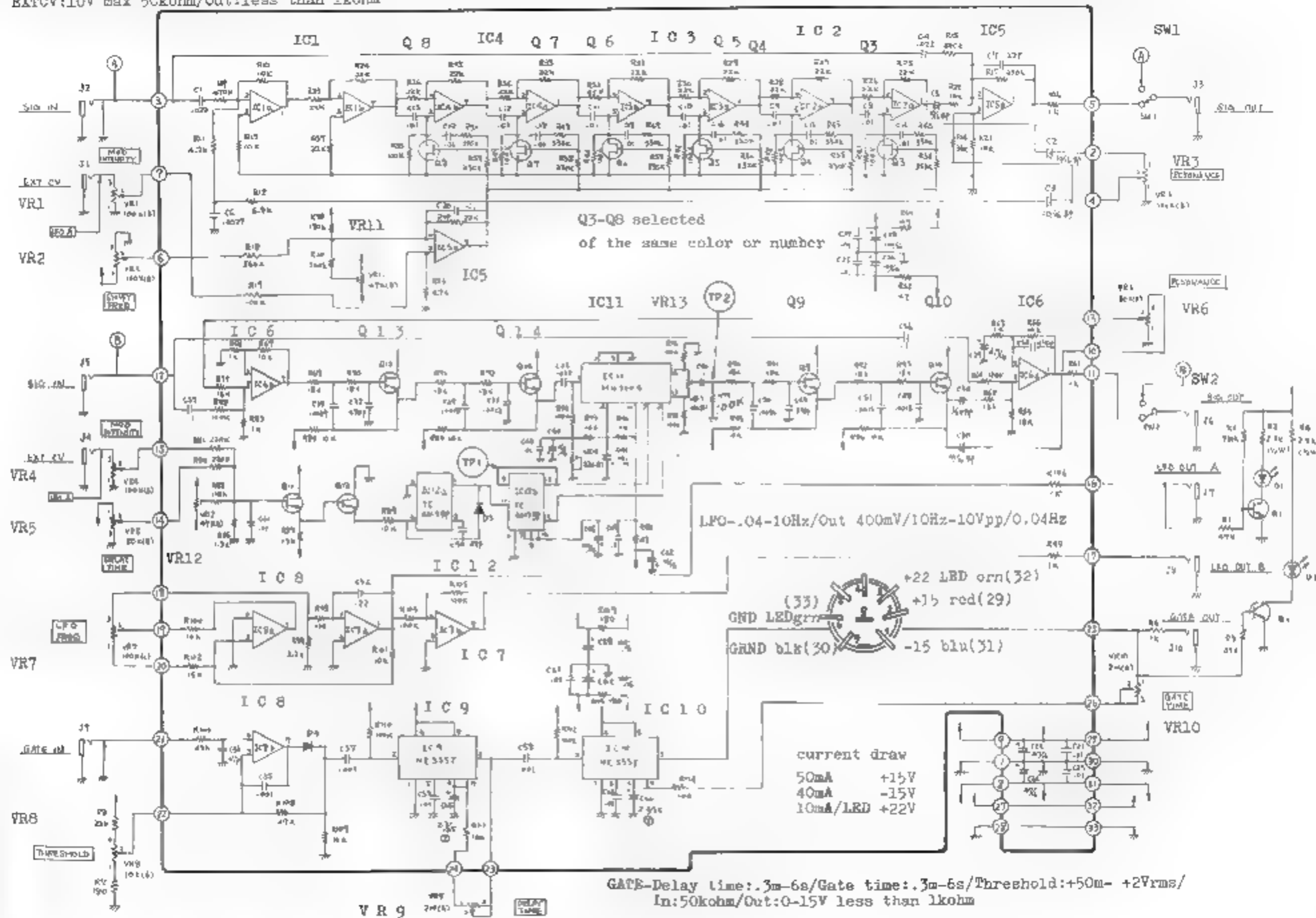
NOMENCLATURE	PART NO.	PART NAME
J- 1-10	13449402	SJ-400-1-2
SW- 1, 2	13159103	88B02242
VR- 1, 2, 4	13219220	VM10RB10C K20 100KB
VR- 3	13219225	VM10RC38C K20 10KB
VR- 5, 6	13219219	VM10RB10C K20 50KB
VR- 7	13219226	VM10RC38C K20 100KC
VR- 8	13219222	VM10MC38C K20 10KA
VR- 9,10	13219221	VM10RC38C K20 2MA
IC- 1,5,6,7,8	15189105	uPC4558C
IC- 2, 3,4	15189102	NJM4558DD EP MONO Dual
IC- 9, 10	15219109	NE555P
IC- 11	15219203	MN3004 BBD
IC- 12	15159105TO	TC4013BP
Q- 1,2,9-11 13, 14	15129107	28C945-Q
Q- 3-8	151391030A	2SK30ATM-GR selected
Q- 12	15119106	28A733-Q
D- 3, 4	15019103	1S2473
C- 65, 66	13619709ND	tantalum 2.2/35V
VR- 11, 12	13299116	SR19R 47KB
VR- 13	13299114	SR19R 10KB
VR- 14	13299115	SR19R 22KB

A. DELAY-.0m-7ms/30Hz-20kHz/ S/N:60dB/In:10V
50k/Out:less 1k/EXTCV:10Vmax 50kohm



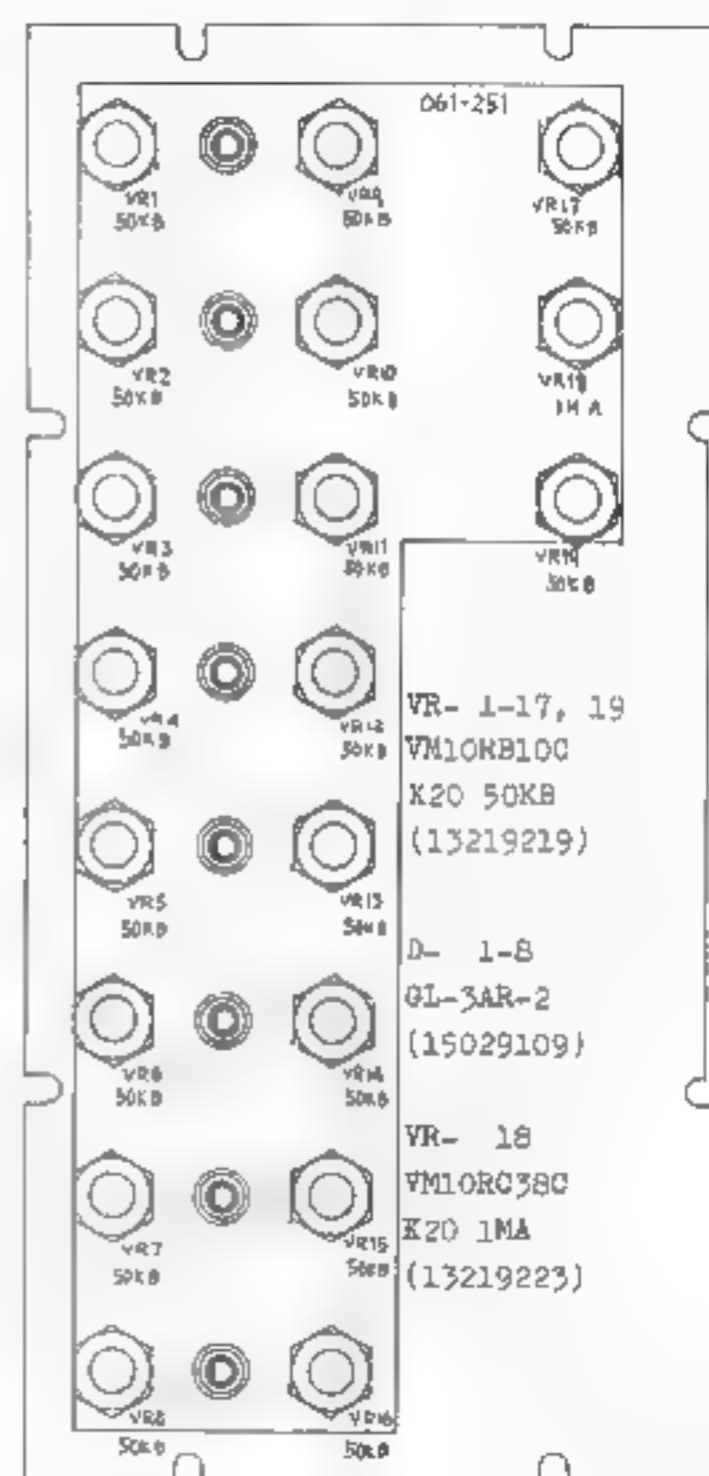
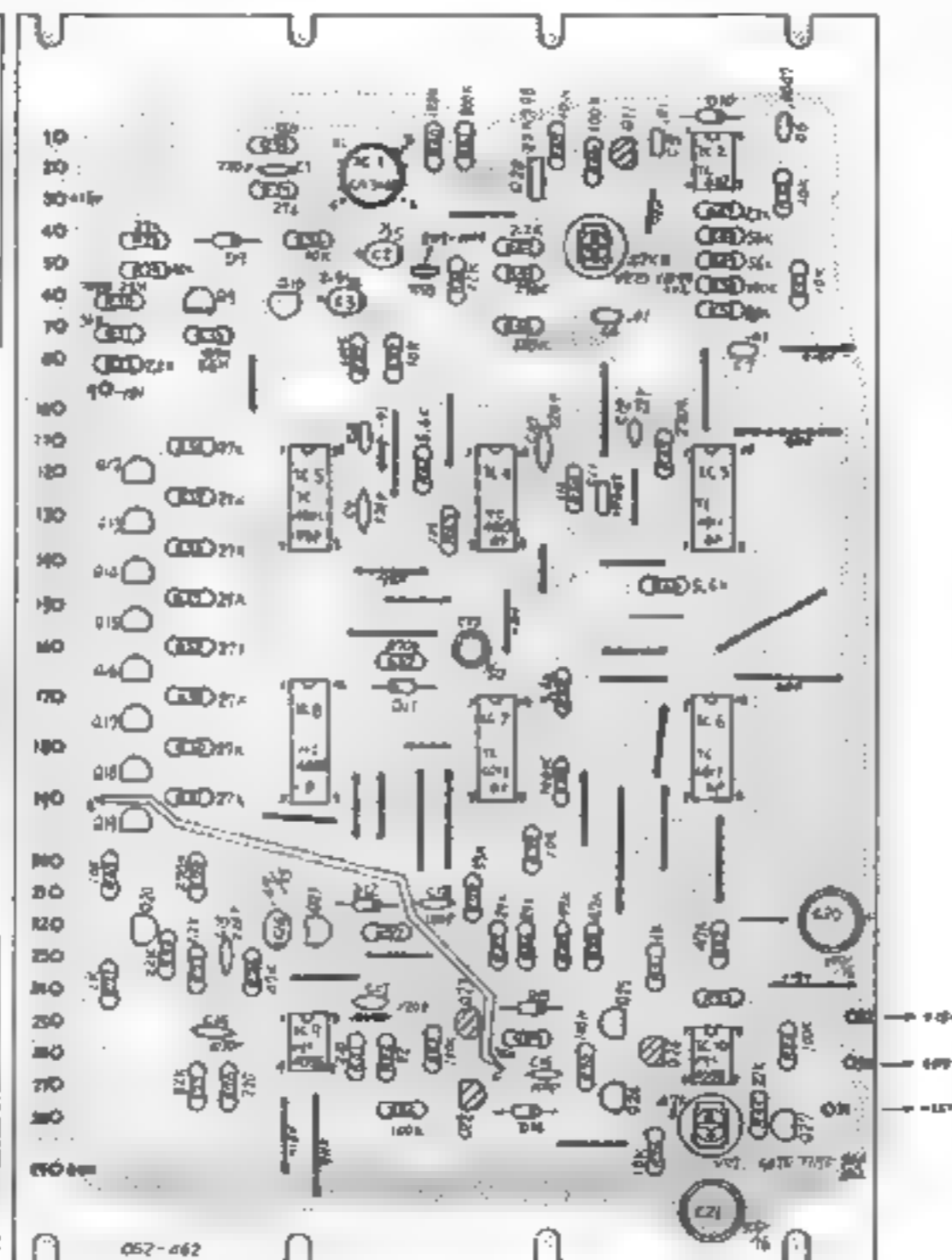
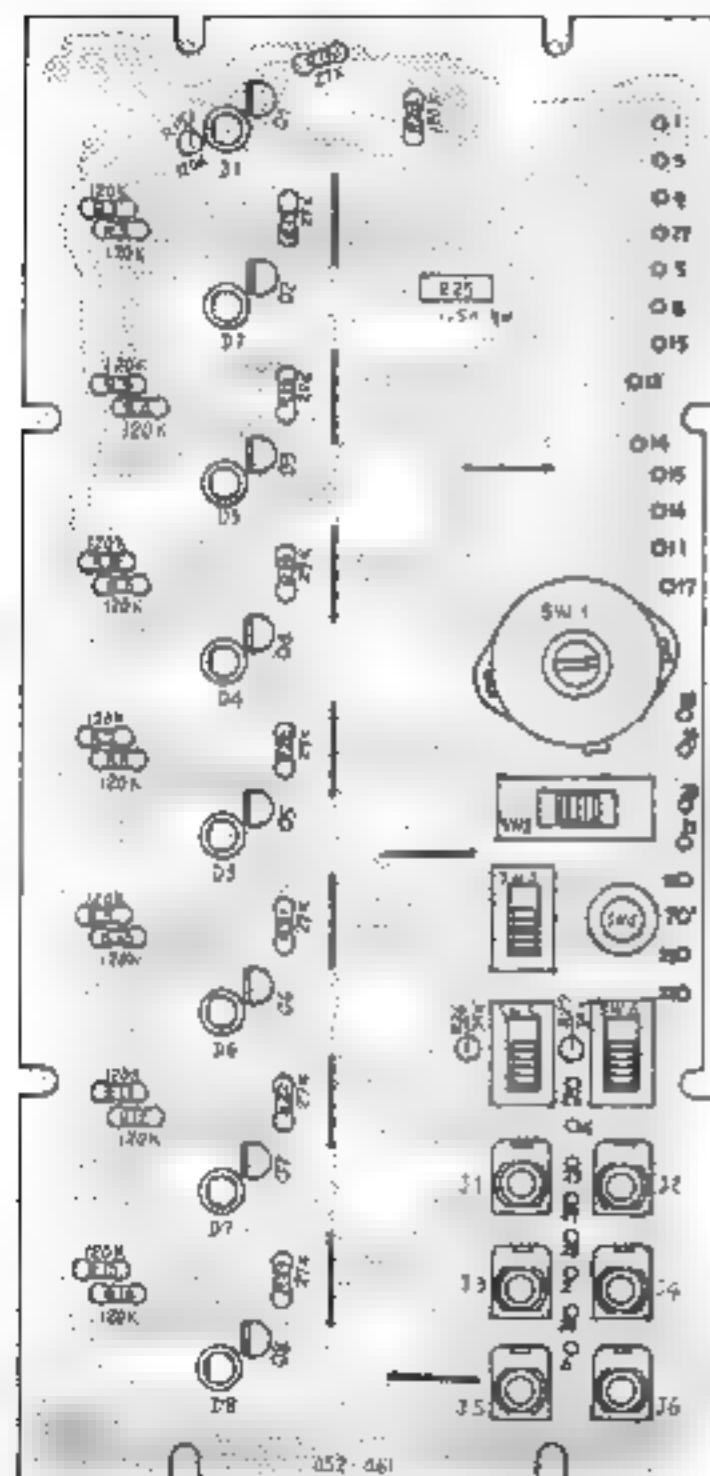
PH.SHIFT-200Hz-8kHz/1080°/7 resp:20Hz-20kHz
 S/N:60dB/In:10V.50kohm/Out:less 1kohm
 EXTCV:10V max 50kohm/Out:less than 1kohm

A.DELAY-.0m-7ms/30Hz-20kHz/ S/N:60dB/In:10V
 50k/Out:less 1k/EXTCV:10Vmax 50kohm



J- 1-6	13449402	SJ-409-1-2	SW- 4	13129901	DS-102 red	IC- 4	15159105T0	TC4013BP	Q- 1-8	15119106	28A733-Q
SW- 1	13119702	SRML018112	IC- 1	15189121	CA3140T	IC- 5	15159102T0	TC4001UBP	Q- 9	15119108	28A798-G
SW- 2	13159302	SSA04301	IC- 2	15189118	TL082CP	IC- 8	15159107Z0	MC14022B	Q- 10,12-21, 24,25,27	15129107	28C945-Q
SW- 3,5,6	13159102	SSA04202	IC- 3,6,7	15159104T0	TC4011BP	IC- 9,10	15189105	uPC4558C			

See bottom for remainders.

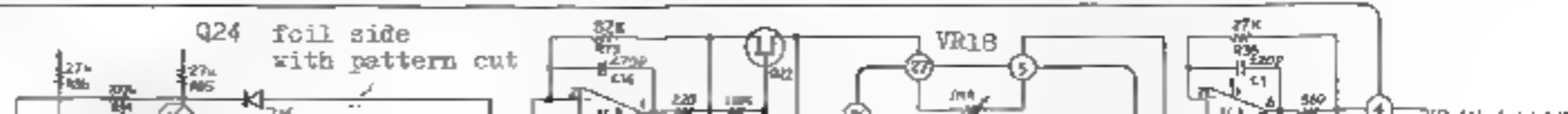


OP110-030 (P/N 7911003000)
(pcb 052-461)

M-182 OP11-040 (Part number 7911004000)
(pcb 052-462)

Tempo: 7e-3ms (0.14Hz-33Hz) PORTAMENTO: 0-10s
Gate time: 10-90%
CV out: 0.3-10V

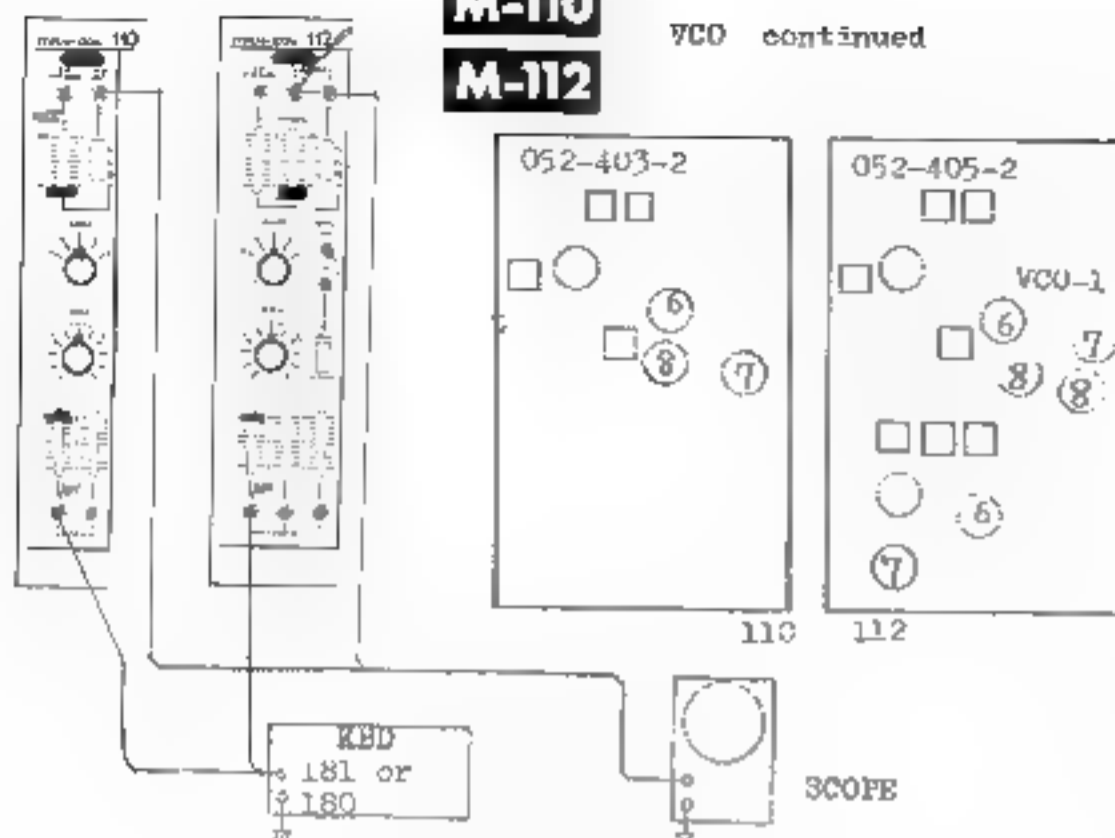
Gate out: +14V
less than 2k ohms
Tempo in: 0-10V/120k



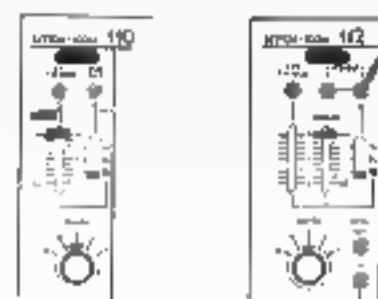
M-110**M-112**

VCO continued

(5) - RECTANGULAR -

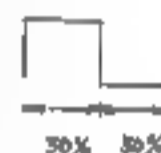


Set OUT switch to .



Set MANUAL to 50% (0).

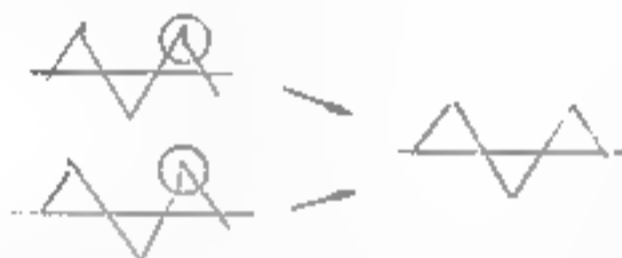
While pressing
2V key, adjust
VR7 for 50%
duty ratio.



(4) - TRIANGULAR -

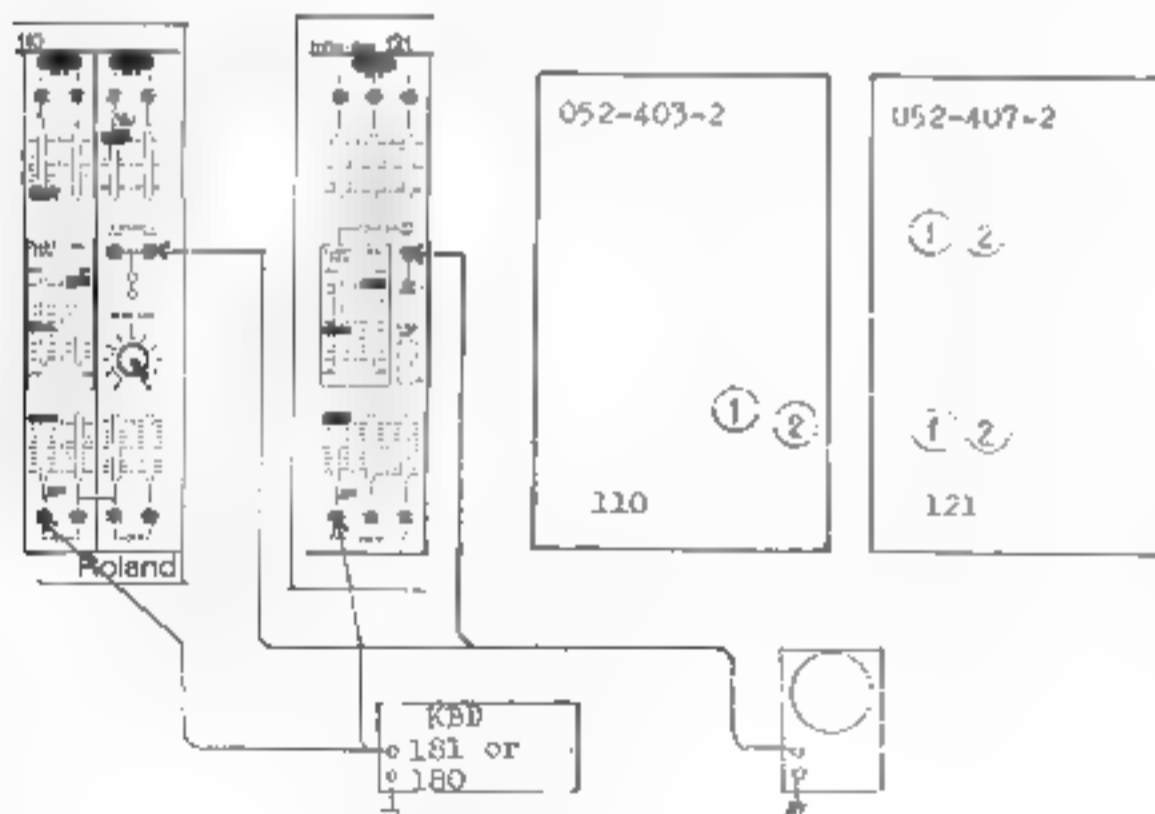
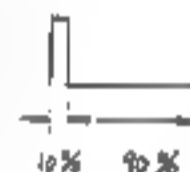
VCO OUT switch: .

With 2V key holding
down, adjust VR6 for
straightness.



Set MANUAL to MIN (10).

While pressing
2V key, adjust
VR8 for 10%
duty ratio.

**M-110**

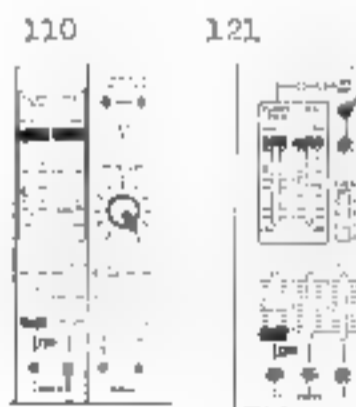
VCF VCF 20.6

M-121

20.6

VCF

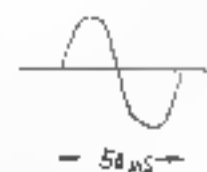
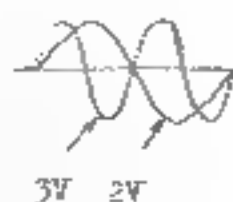
(2) - FREQUENCY -



(1) - WIDTH -

Make sure that VCF oscillates when
RES knob is set around 7-8th line.

While quickly playing 2V and 3V keys alternately,
adjust VR1 for waveforms 1:2 in frequency.



Adjust VR2 for 20kHz (50us).

ADJUSTMENT

For M-180 and M-181, see pp. 16-17.

M-110 VCO-VCF-VCA

M-112 VCO

The following precautions should be kept in mind before starting adjustment on M-180 and M-181.

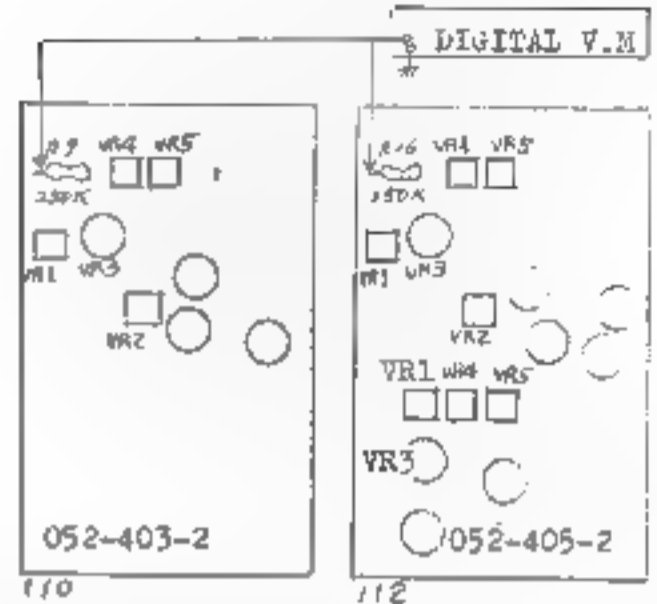
Leave the test and testing equipments turned on for 20-30 minutes as a warmup period.

Keep room at a normal and constant operating temperature.

Check keyboard KCV or reference voltage for 1V/oct ($\pm 1mV$).

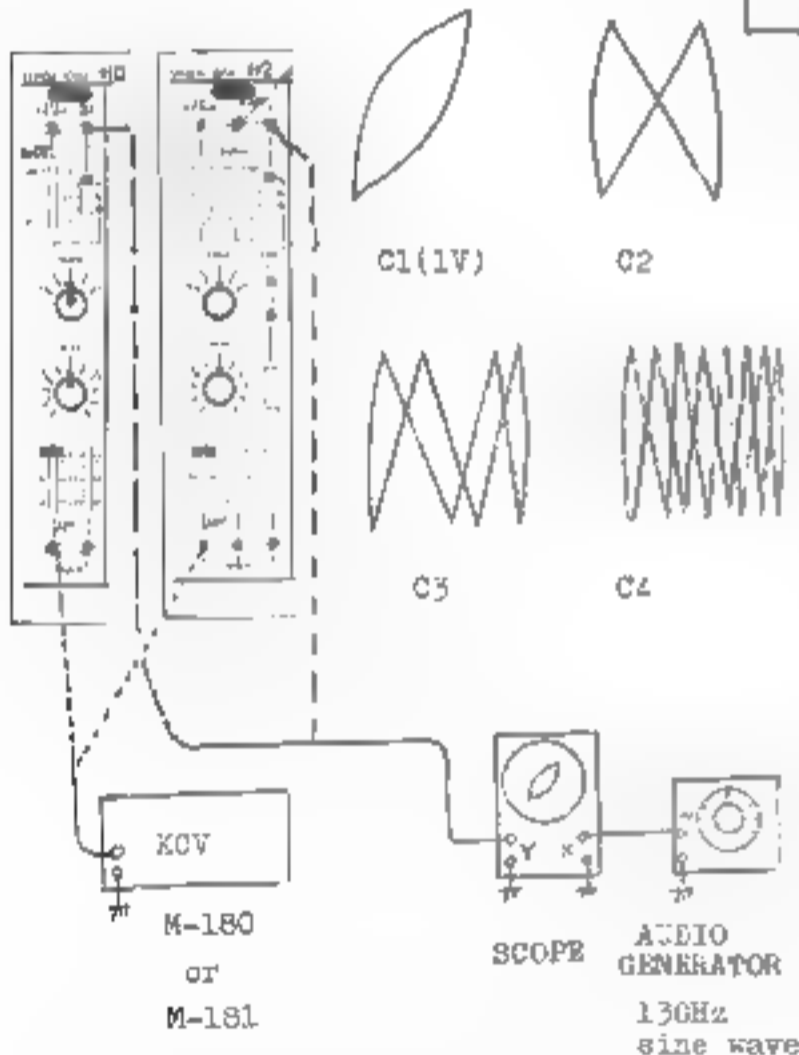
VCO

(1) - RANGE - coarse



Trippot designations are independent of those on circuit diagrams.

110 112



KEY DESIGNATION

M-181



M-180



F1 C2 C3

Connect digital voltmeter to R9 or R16 lead.

1. Set VR1 around its midpoint.
2. Adjust VR2 for 1.0V reading.

(2) - WIDTH. FREQUENCY -

Set VR3 and VR4 around the midpoint.

1. While pressing 1V key (M-180 C2 key with TRANSPOSE set in L; M-181 C1 key), adjust VR4 for 1:1 Lissajous (WIDTH).
2. With 2V key holding down, adjust VR5 for motionless waveform.
3. Repeat steps 1 and 2 until waveforms stand still.
Tolerance at 2V key: cycle/5s (0.2Hz).
4. Pressing 5V key, lock Lissajous with VR3. (LINEARITY) (M-180: C4, TRANSPOSE H)

Turning VR3 will affect previous adjustments in this section. Repeat from step 1.

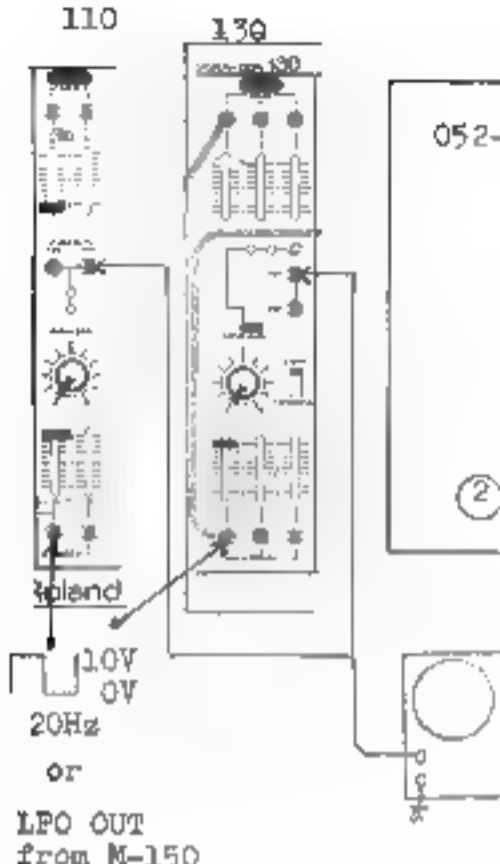
Tolerance: 1Hz at 4V key.

(3) - RANGE - fine

Keep 1V key pressed down.

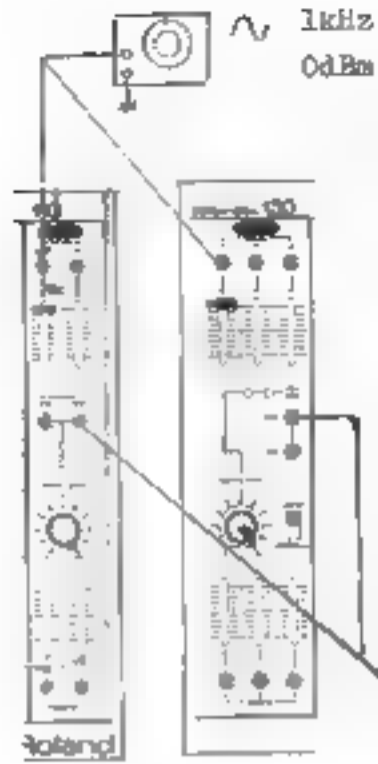
While continuously rotating RANGE knob across full travel range, adjust VR1 for the least detune at every RANGE setting.

VCA



(1) - DC BALANCE -

1. Adjust VR1 for minimum amplitude. Increase scope's Vertical gain as the output reduces.



(2) - OFFSET -

1. Adjust VR2 for 0dBm reading
2. Check signal for leakage with INITIAL GAIN set at FCCW (0).

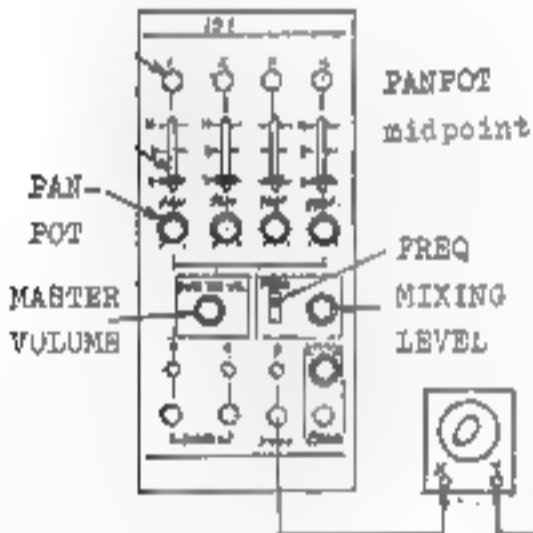
(3) - VCA GAIN - M-130 only

1. Set Changeover switch to EXPONENTIAL.
2. Adjust VR3 for 0dBm reading.

PEAK INDICATOR

M-131 OUTPUT MIXER

STANDARD OSC



With MASTER VOL set FCW, advance MIXING LEVEL to 8. LEDs will come on - MONO, then R or L (depends on PANPOT position).



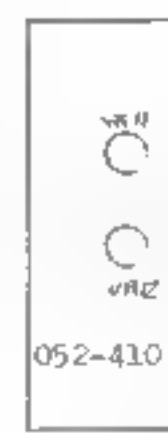
1. Set FREQ to 440Hz.
2. Set MASTER VOL and MIX LEVEL for proper level.
3. Turn L1 with nonferrous metal tool for 1:1 Lissajous.

M-132 DUAL CV AUDIO MIXER & VOLTAGE PROCESSOR

VOLTAGE PROCESSOR

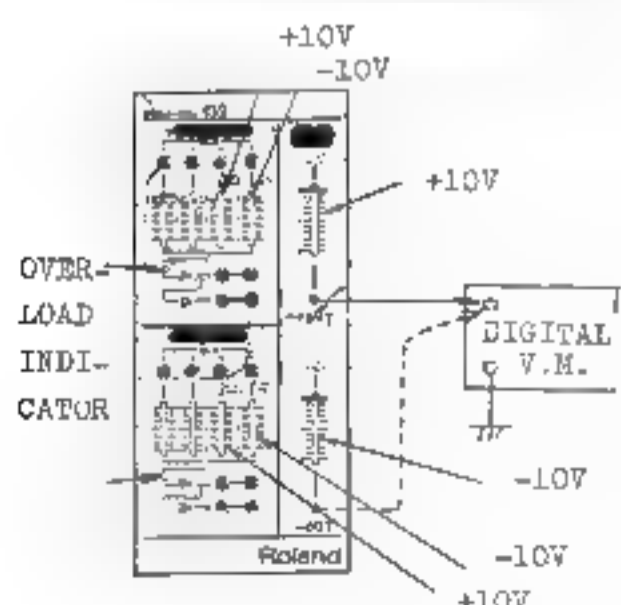
MIXER-1.2

- (1) - +10V -
1. Set +OUT slider at +10.
 2. Adjust VR11 for $10.5 \pm 10mV$.
- (2) - -10V -
1. Set -OUT slider at -10.
 2. Adjust VR12 for $-10 \pm 10mV$.



- OVERLOAD INDICATOR -

Check that LEDs light respectively under the following settings.



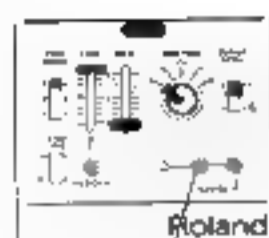
MIXER-1

SIG IN slider	NO. 3
NO. 4	NO. 3
0	9-10
9-10	0

MIXER-2

SIG IN slider	NO. 3
NO. 4	NO. 3
0	9-10
9-10	0

LFO



(1) - FREQUENCY -

Adjust VR1 for 30Hz (33ms).

(2) - AMPLITUDE -

Adjust VR2 for 10V p-p.

Change WAVEFORM to SAWTOOTH.

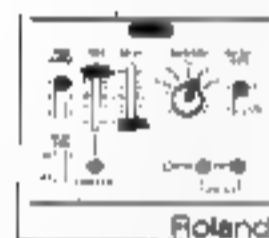
140
052-411-2

150
052-414-2

③
①
②

(3) - SAWTOOTH -

Adjust VR3 for straightness.



M-150

NOISE

Adjust VR1 for 18V p-p.
(early M-150: 12-14V)

RING MODULATOR

(1) - SIGNAL BALANCE -

Insert short circuit plug into EXT SIG X jack to place a ground to the jack circuit.

Adjust VR2 for minimum RING OUT.

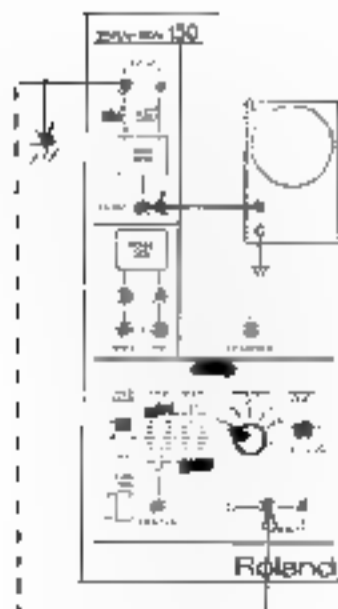
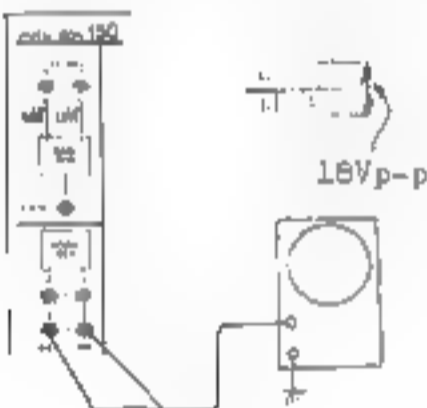
(2) - MODULATION BALANCE -

Connect EXT SIG X to LFO OUT.

Adjust VR3 for distortion free output.
Modulated waveform doubles the input in frequency.

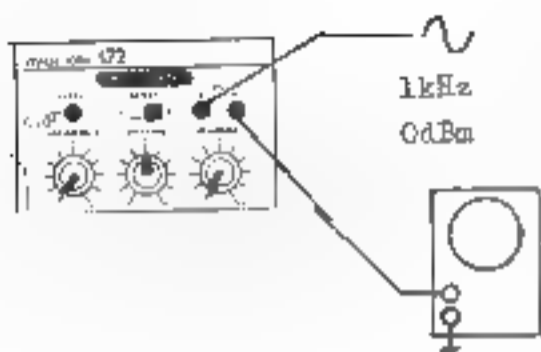
②
③
①

052-414-2



PHASE SHIFTER

- SHIFT FREQUENCY -

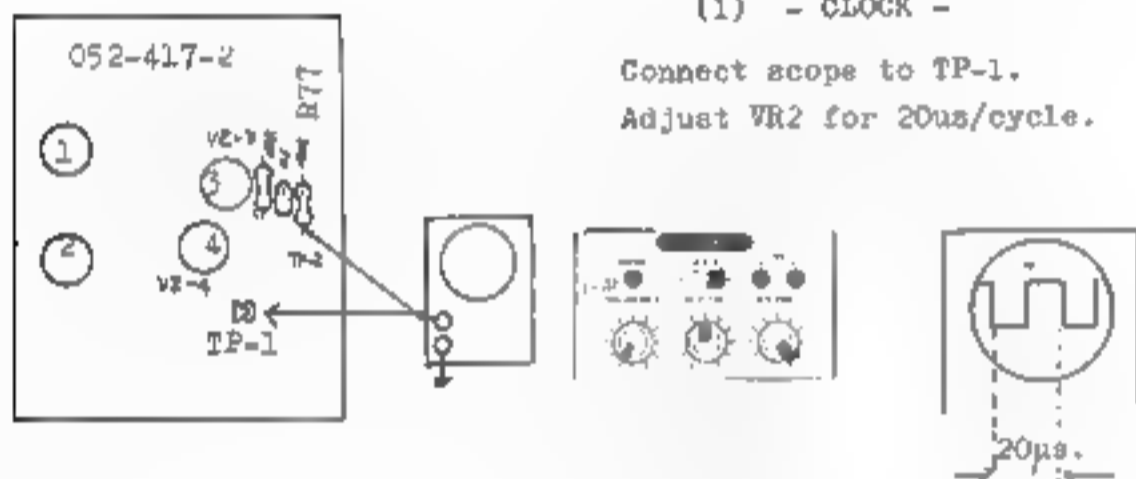


1. Rotate VR1 PCW to/from FCCW;
level of PHASE SHIFTER output
will decrease to minimum three
times per full rotation.
2. Stop the rotation at the 2nd,
and fine-tune VR1 for the
minimum waveform level.

AUDIO DELAY

(1) - CLOCK -

Connect scope to TP-1.
Adjust VR2 for 20ns/cycle.



(2) - BBD OUTPUT BALANCE -



Connect scope to TP-2.
Adjust VR3 for smooth envelope.



(3) - BBD BIAS -

Connect scope to AUDIO DELAY SIG OUT.
Advance audio generator level control
until some distortion occurs.

Free waveform from distortion
by turning VR4.



LFO

Check LFO OUTs (A,B) for the following:

Frequency shifts 0.04Hz-10Hz as FREQUENCY

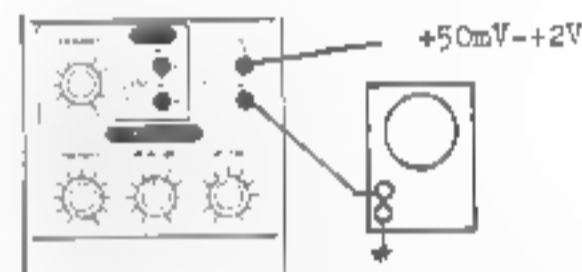
Amplitude varies with frequency.

10V p-p at 0.04Hz

400mV p-p at 10Hz

Waveforms from OUT A and B are 180° out of
each other.

GATE DELAY



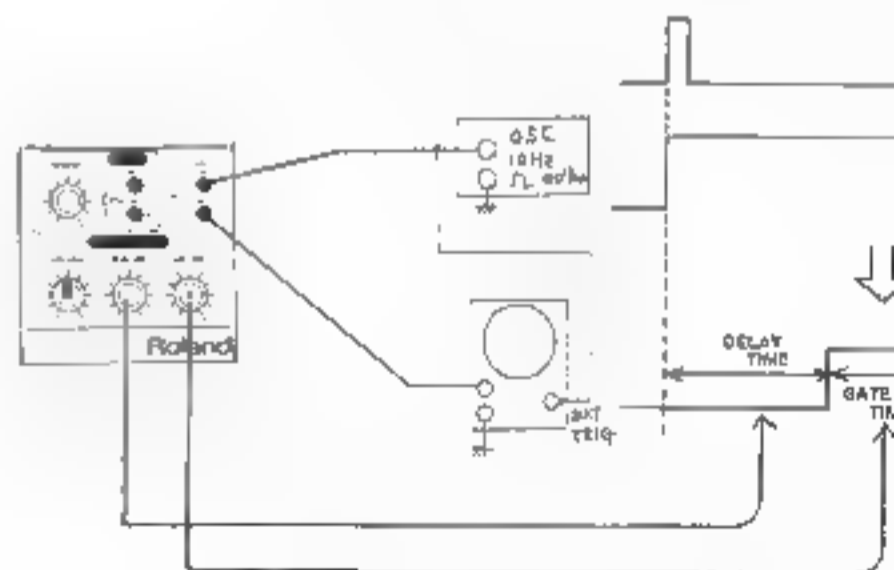
(1) - THRESHOLD

Check that GATE OUT provides +15V in the fo
input levels and settings:

input +50mV±10% . . . THRESHOLD FO

input +2V±20% . . . THRESHOLD p

(2) - DELAY TIME & GATE TIME -



Lengths of DELAY TIME and GATE TIME are as :

DELAY TIME	delay time	GATE TIME
FCCW (0)	0.3ms	FCCW (0)
PCW (10)	6s	PCW (10)

for the following:
 0.4Hz-10Hz as FREQUENCY advances.
 with frequency.
 0.4Hz
 10Hz
 and B are 180° out of phase with

GATE DELAY

+50mV-+2V

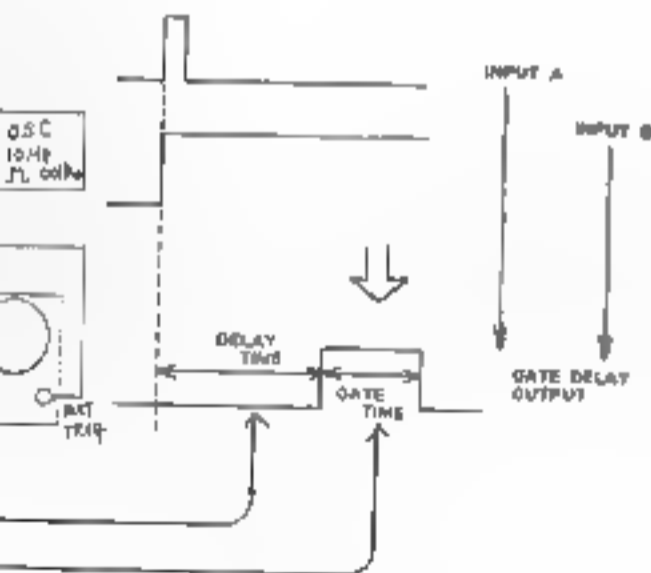


(1) - THRESHOLD -

provides +15V in the following
 ings:

0% . . . THRESHOLD FCCW
 . . . THRESHOLD FOW

TIME & GATE TIME -



and GATE TIME are as follows:

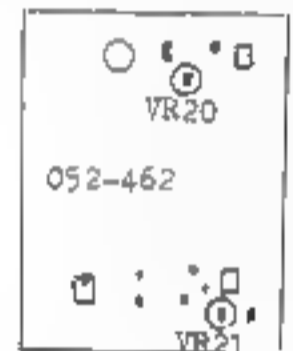
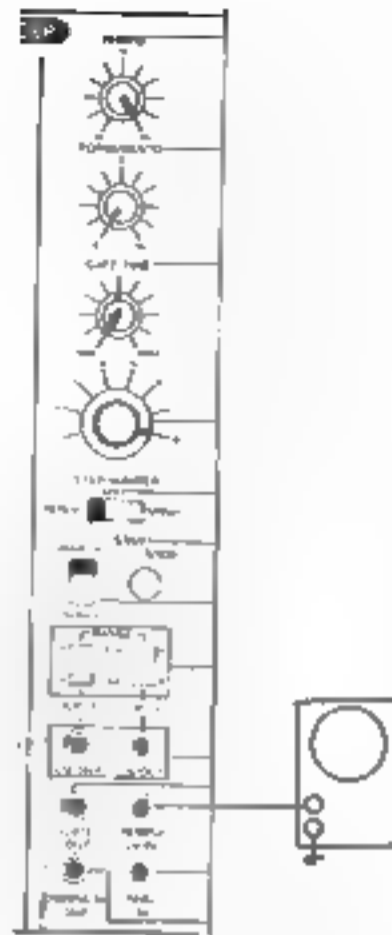
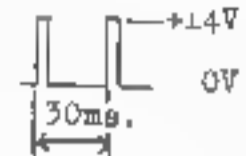
me	GATE TIME	gate time
FCCW (0)		0.3ms
FCW (10)		6s

GATE

(1) - TEMPO -

Set controls as illustrated at left.

Adjust VR20 for:



(2) - LED ON/OFF TIMING -

With TEMPO at "0", a LED stays on for 7 seconds before
 the next LED lights.

With TEMPO at "5", LED lighting duration is approxi-
 mately 0.5 seconds.

(3) - DUTY CYCLE -

Keep initial settings shown above.
 Turn GATE TIME FOW.

Adjust VR21 for 90±2% duty ratio.

Reverse GATE TIME (FCCW).

1. Adjust TEMPO to display one cycle of waveform across ten divisions on graticule.
2. Check that duty ratio is 8-12%.

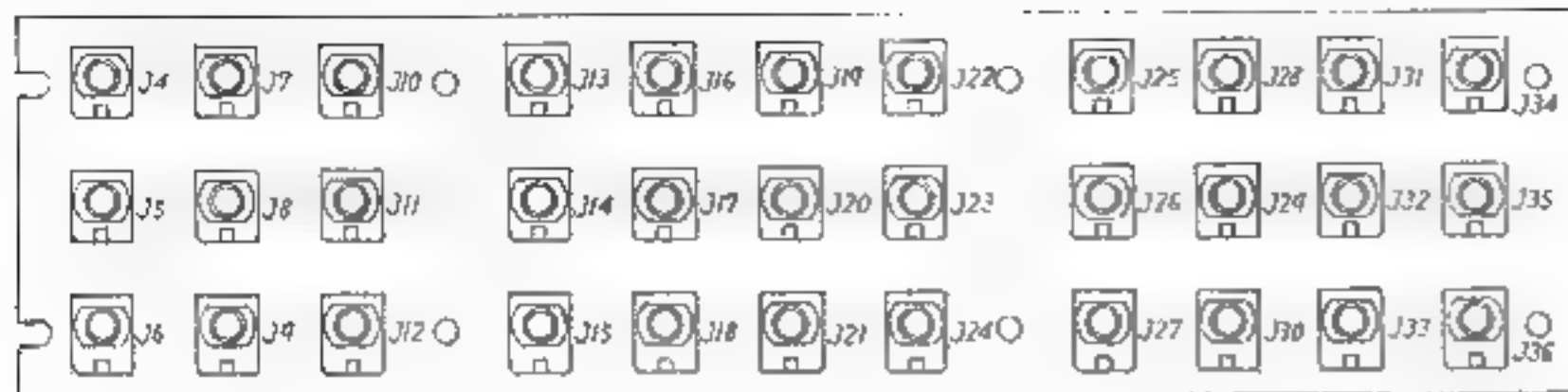
Set GATE TIME at "4".

Check that duty ratio is 50%
 (±7%)



M-191J OPH53 (149H053) (pcb 052-423)

JACKS HSJ0409-01-020



IC-	1	15119110T0	TA7179M
Q-	1	15119800	28B434-0
Q-	2	15129801	28D234-0
D- 1-4		15019210	1R5B261 or 1N4003 1.5A 100V
D-		019-020	LR0601R LED
VR-	1	13299117	SR19K 100KB
R- 1,2		044-589	ERG-01ANJ 0.82 ohms 1/2W
P.T.		022H025J	100V
		022H0250	117V
		022H025D	220/240V

100/117V



Fuse holder
012H022 F-3265

F- 1-3
12559114 KCC 1.0A
100V
12559302 KCC0001
117V

220/240V



Fuse holder
12199516 B-N5054

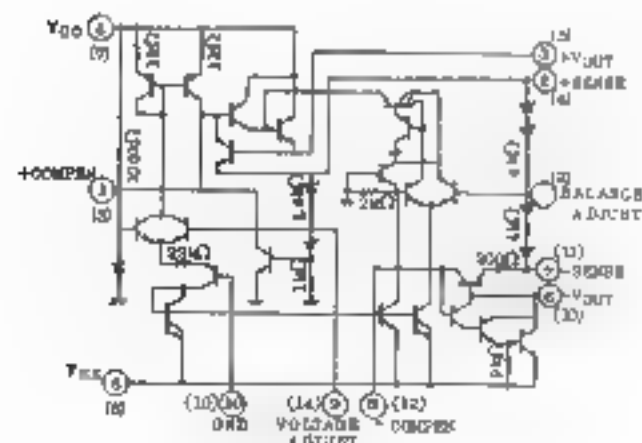
F-
12559511 CBB T500mA
F- 2, 3
12559513 CBB T1A

HS- 1, 2 046-052 Heat sink no.52

HS- 3
048H023
RH-21 (IC1)



EQUIVALENT CIRCUIT



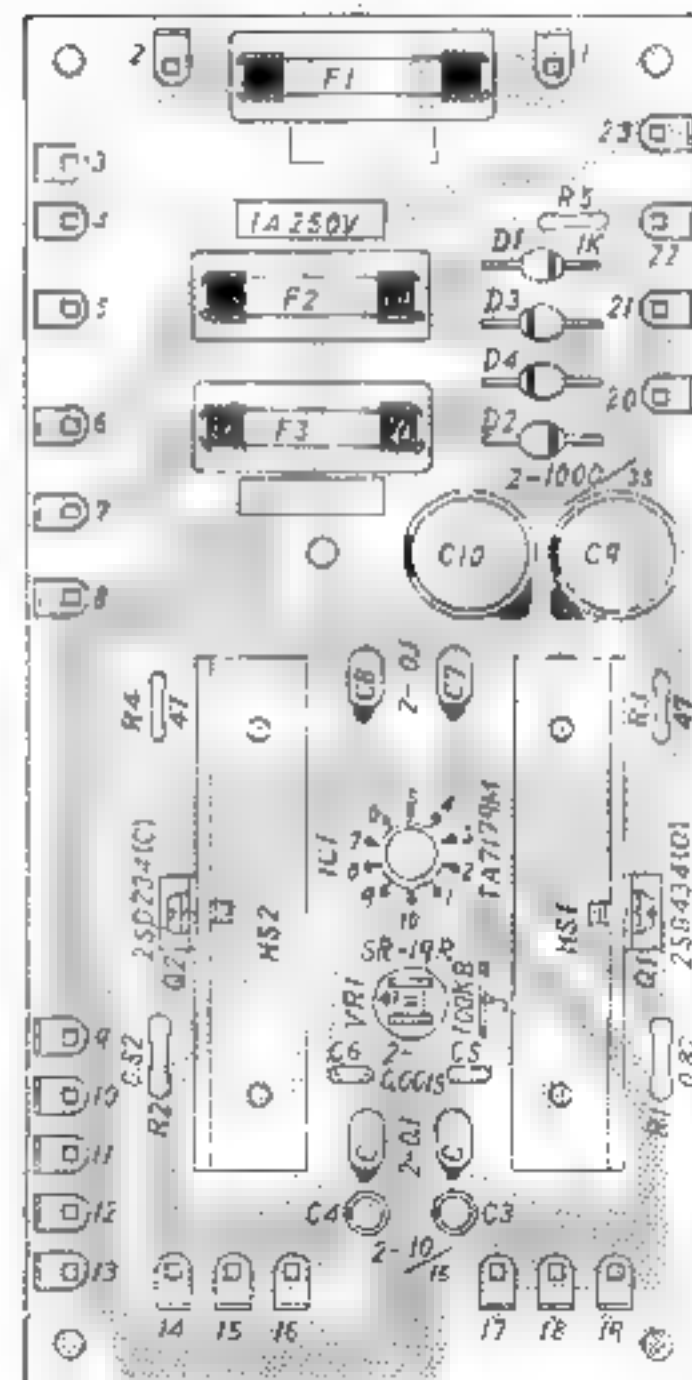
TA7179M

Pin numbers
in parentheses
are for the plastics
type TA7179P only.

ABSOLUTE	Input voltage	(+) (-) 30V
MAXIMUM	Output current	(+) (-) 100mA
RATINGS	Power dissipation	500mW
(T=25°C)	Operating temperature	-30°-+75° C

M-190 M-191J

PS-46B (146-046B) 100V
PS-47B (146-047B) 117V
PS-48B (146-048B) 220/240V
(pcb 052-421B)



EXPANDER

MODULE-1

MODULE-2

MODULE-3

MODULE-4

MODULE-5

TRIG
GATE



KLYSOPAC
IXL-III

NOMENCLATURE	PART NO.	PARTS NAME
SW- 1	13139131	SLB-623-12P(S)
VR- 1	028-720	VM10BK15(L)A26 2MA
VR- 2	028-727	VM10BK15(L)B15 100KB
VR- 3	13299504	PN82-2H202H 2KB
VR- 4	13299506	PN82-2H501H 500 ohms
IC- 1	15189131	LF13741H
IC- 2	15189121	CA3140T
IC- 3	15189109	uA301BC
IC- 4-6	15189105	uPC4556C
Q- 1-5	15129115	29C1815-Y
Q- 6, 7	15119112	2SA1015-Y
Q- 8	15139103	2SK30ATM-GR
D- 1	15019627	1S2454 zener
D- 2-7	15019103	1S2473
C- 4	polypropylene	ECQP-2334MZ
C- 5	tantalum	1mfd 35V
R- 23,24		CRB+FX 0.1% selected
R-		CRB+FX 1%

ADJUSTMENT

PB-4 (M-181 only)

When PB-4 is replaced with a factory assembled one, step 1 is negligible.

Connect a voltmeter (preferably, digital type for precise measurements) into BSMR OUT jack.

1. With PB-4 lever left at neutral, position VR-5 wiper for 0±1mV reading.
2. With the lever held at leftmost position, set VR-7 on OP-98 for -5V reading.
3. With the lever held at rightmost, set VR-6 for +5V reading.

TUNING

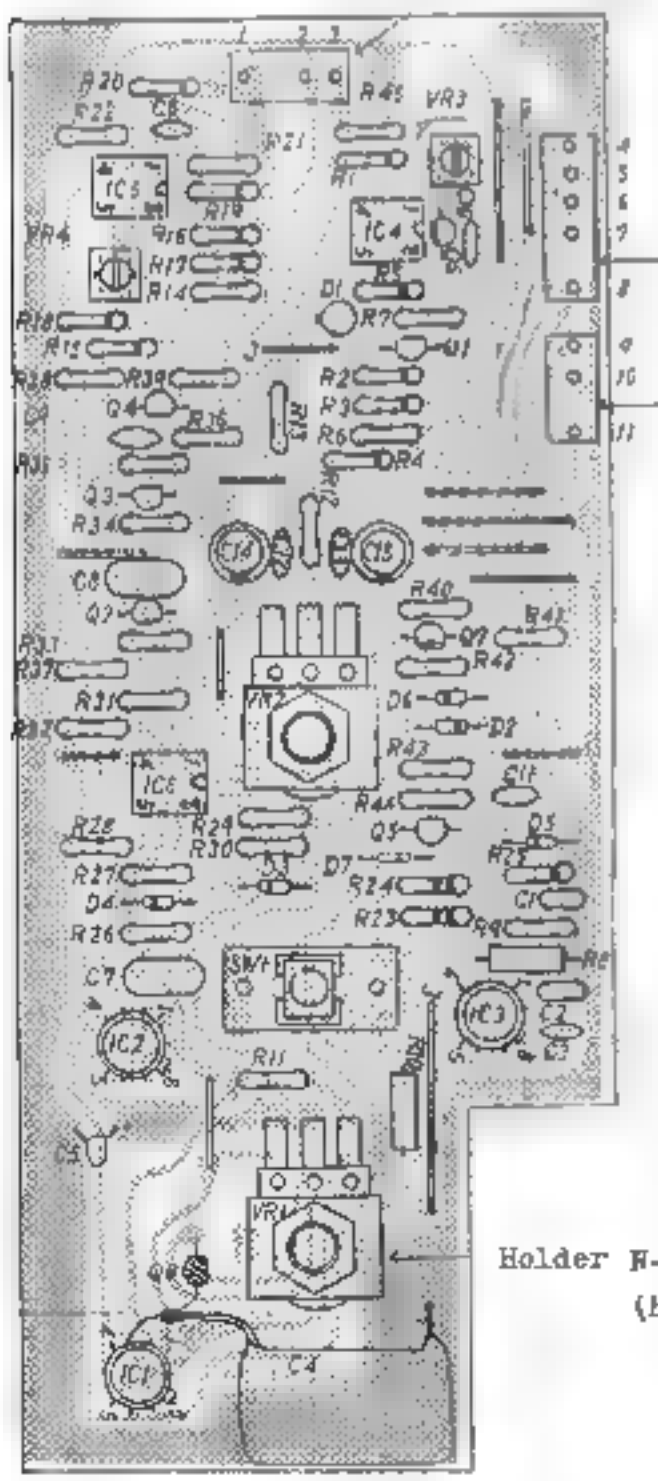
Connect voltmeter

1. WIDTH
 - a. While pressing key, note the reading.
 - b. While pressing key, adjust VR-4 for 2V reading.
 - c. Check the reading in 1V/oct.

2. SHIFT

While pressing key

VR-4 for 2V reading

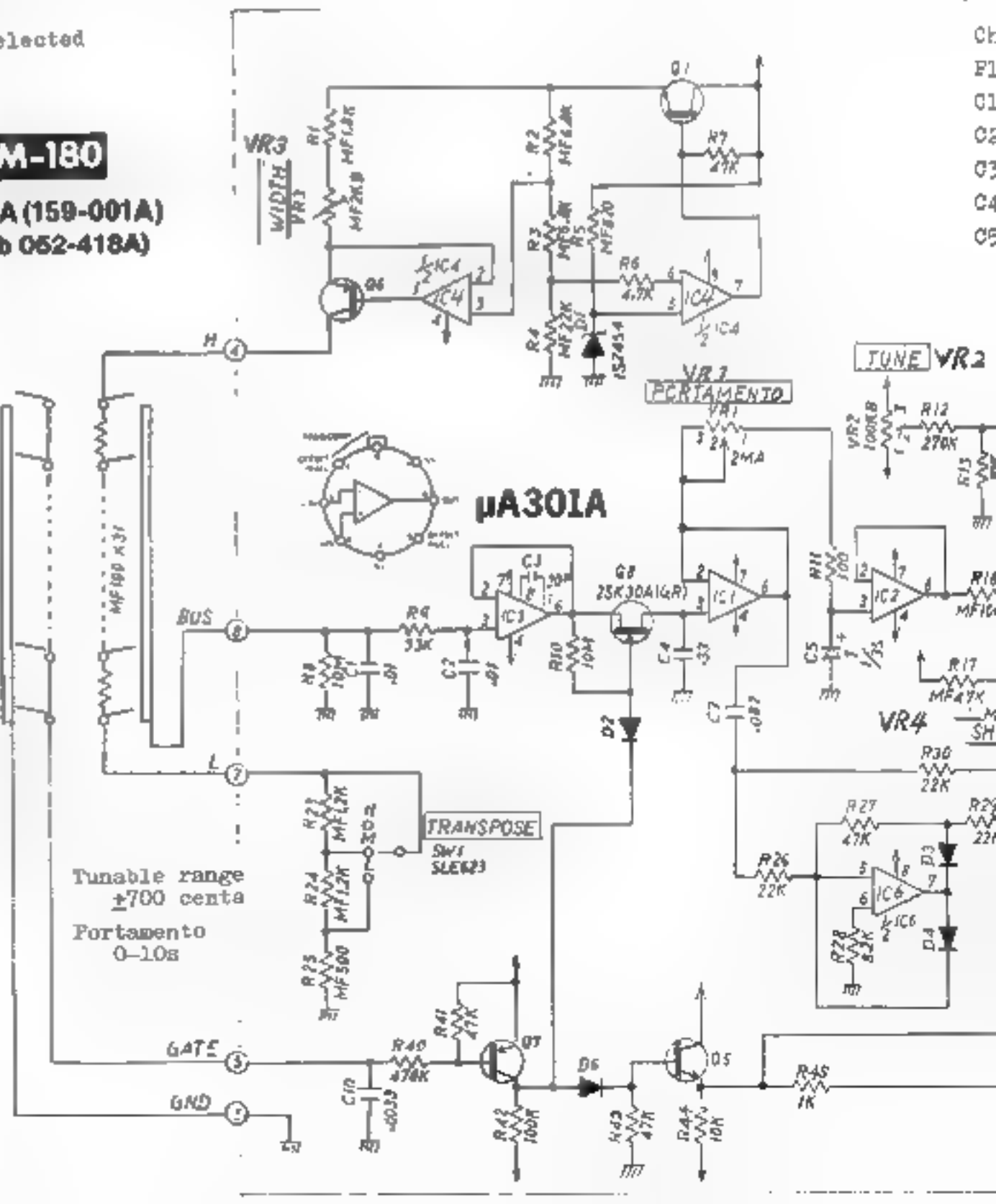


M-180 CV-1A (159-001A) (pcb 052-418A)

KEY-BOARD 32NOTE
SK-132B

Tunable range
±700 cents
Portamento
0-10s

Holder M-106
(H55A)



3. TUNABLE RANGE

CV should lower by 0.5V when TUNING VR-2
■ turned from 0 point to FCGW, and
should rise by 0.5V when VR-2 turned 0
to FCG.

4. TRANSPOSE

- CV should vary by 1V when TRANSPOSE is set from M position to L or H.

5. PORTAMENTO

(M-181 - SW-2 on -)

Turn PORTAMENTO fully clockwise.

- a. Press the lowest key, then, the upmost key. The time required for CV to reach the voltage specified by latter key is 23s.
- b. Reverse the above key pressing order. The time is also 23s.

Check:

P1 = 2.416V (M-180)

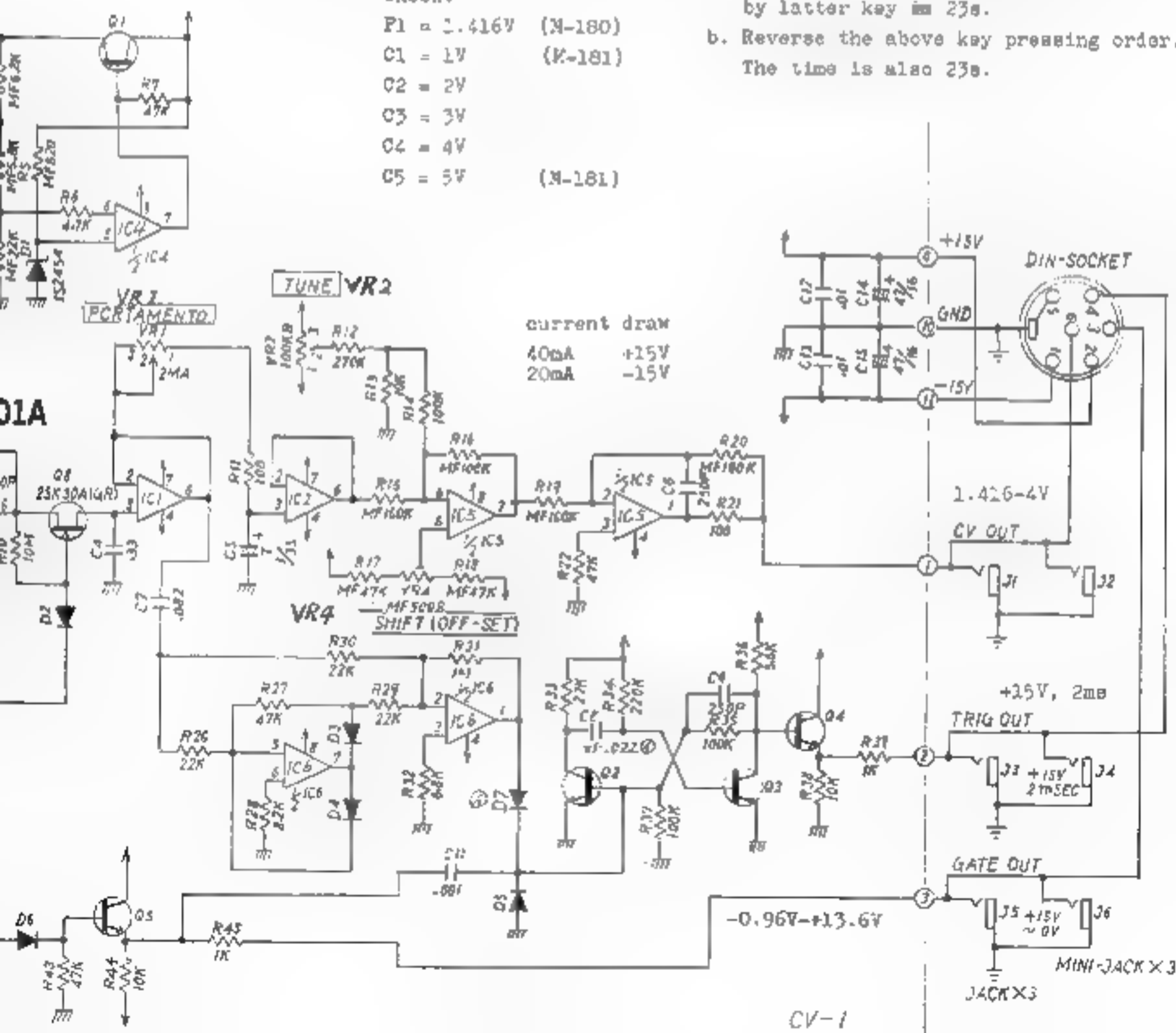
C1 = 1V (K-181)

$$C_2 = 2V$$
$$C3 = 3V$$

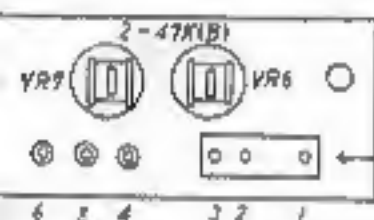
$C_2 = 4V$

C5 = 5V (M-181)

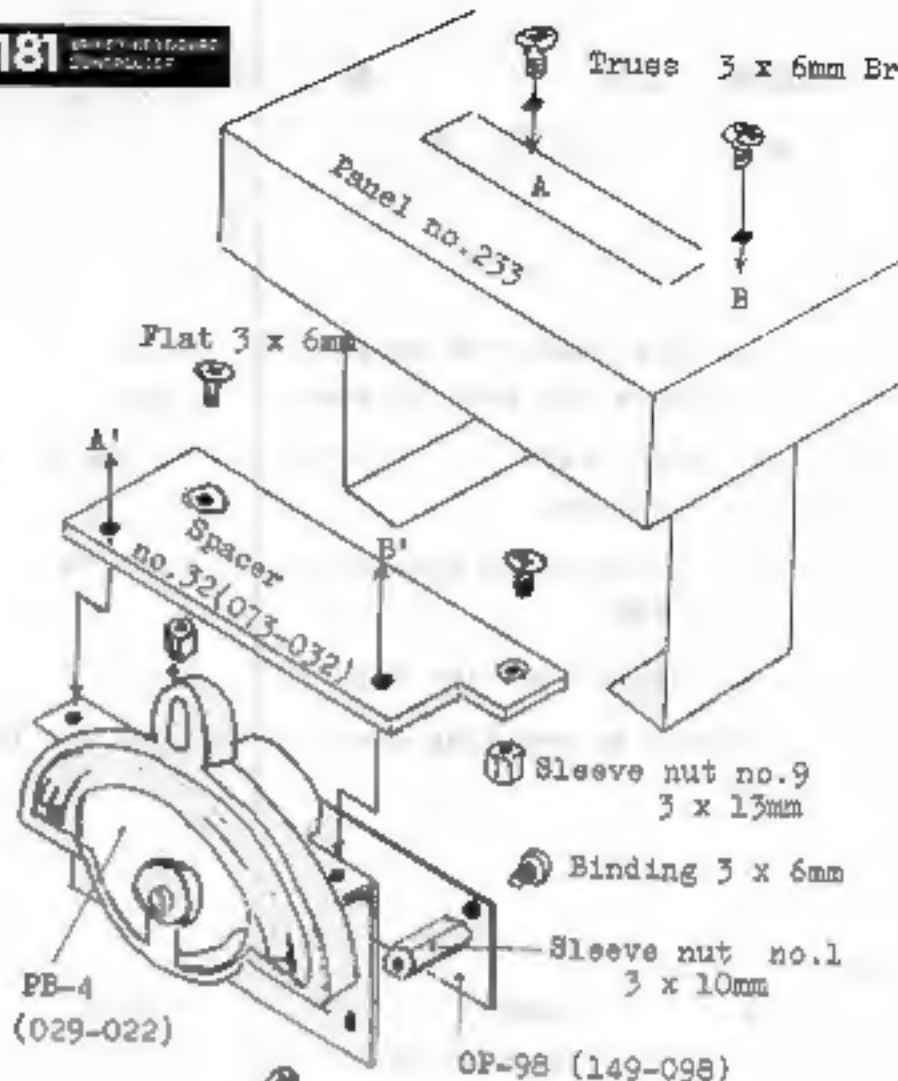
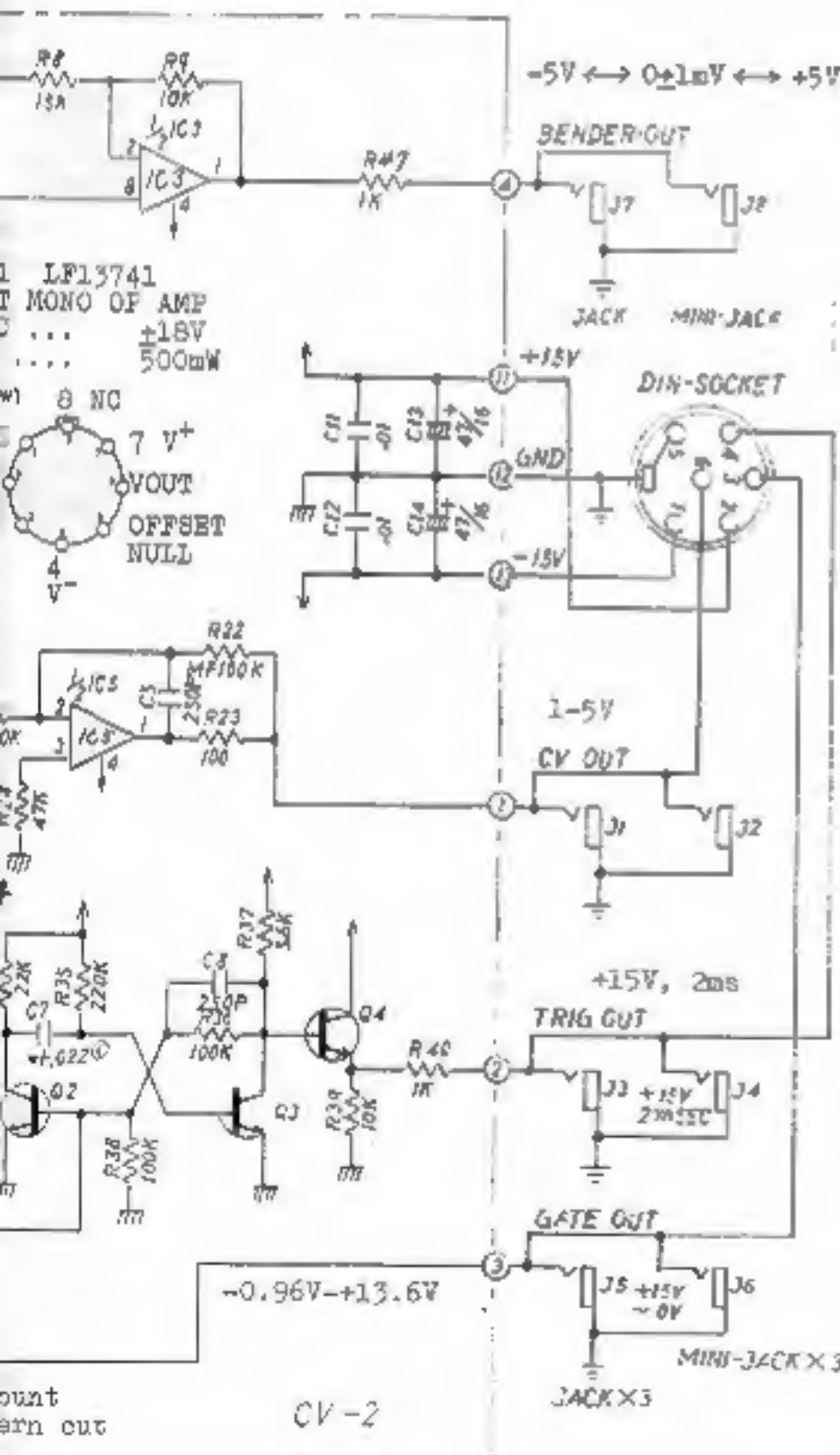
current	draw
40mA	+15V
20mA	-15V



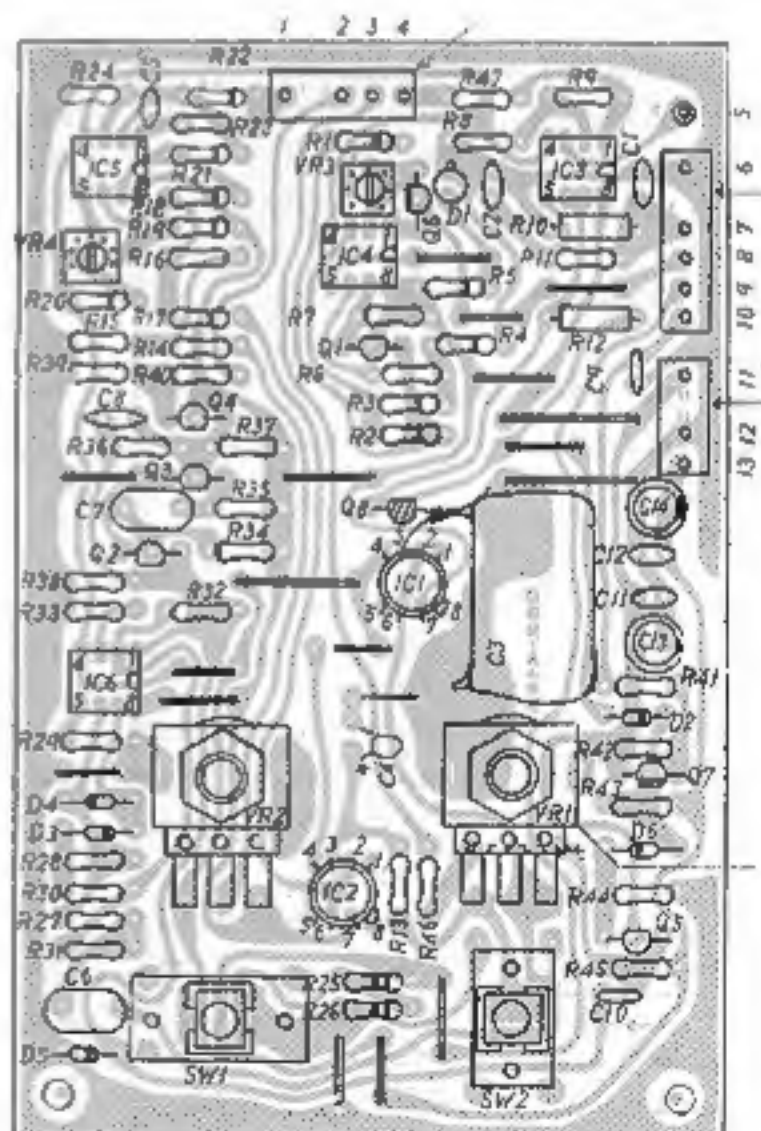
Q-	1-5	15129115	2SC1815-Y
Q-	6, 7	15119112	2SA1015-Y
Q-	8	15139103	2SK30ATM-GR
D-	1	15019627	1S2454 zener
D-	2-7	15019103	1S2473
R-	25, 26		CRB1PX 0.1% selected
R-			CRB1PX metal film
C-	3	polypropylene	ECQF-2334MZ 0.33mfd
C-	4	tantalum	lmfd 35V



OP98 (149-098)
(pcb 052-420)



CV2A (159-002A)
(pcb 052-419A)

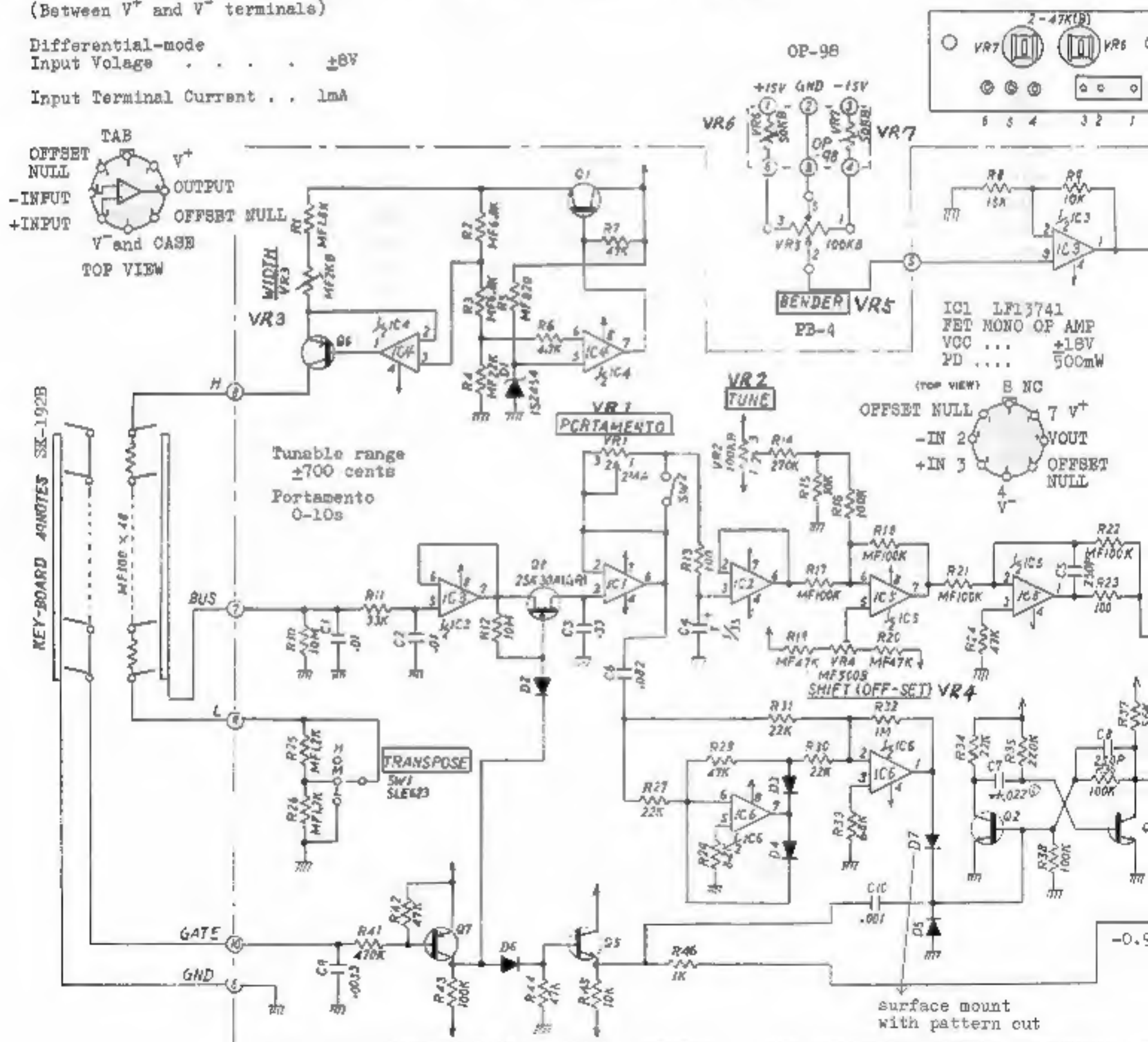


While depressing a key, tap the lower key. This keying should cause TRIG OUT to send out pulses each time the contact closes and opens.

Input Terminal Current . . 1mA

NOMENCLATURE	PART NO.	PARTS NAME
SW- 1	13139131	SLE-623-12P(S)
SW- 2	13139130	SLE-622-12P(S)
VR- 1	028-720	VM10RK15A26 2MA
VR- 2	028-727	VM10RK15B15 100KB
VR- 3	13299504	PN82-2H202H 2KB
VR- 4	13299506	PN82-2H501H 500
VR- 5	029-022	PB-4 assy
VR- 6, 7	13299116	SR19R 47KB
IC- 1	15189131	LF13741H OP amp
IC- 2	15189121	CA3140T
IC- 3-6	15189105	uPC4558C

Q-	1-5	1
Q-	6, 7	1
Q-	8	1
D-	1	1
D-	2-7	1
R-	25, 26	
R-		
C-	3	p
C-	4	t



GENERAL PARTS LIST & CROSS-REFERENCE

Old number to New number

This list confines itself to components finding applications not only in modules but also in some other models.

For the rest parts, refer to illustration on the front cover or individual sections.

Some type names consist of abbreviated numbers following N- which stands for NEW.

Module names list by last two digits.

Use of new number on ordering sheet encourages the factory for dispatch.

KNOB

OLD	NEW	NAME	MODULE
016-044	. . .	Knob no.44 rotary	80/81
016-077	2247012700	Knob N-127 rotary	31/82
016-078	2247012800	Knob N-128 rotary	10/12/30/31/40/50/72/82
016-079	2247012900	Knob N-129 slide	10/12/21/30/31/32/40/50

JACK, SOCKET

009-039	13449402	SJ-409-1-2	10/12/21/30/31/32/40/50/72/82/90/91
009-015	13449111	HLJ-102-1-4	80/81/90/91
009-030	13449115	HLJ-0264-01-030	31
009-007	. . .	SG-8050#4	80/81
009-040	13449114	HLJ-0264-01-020	31
009-016	. . .	P-254P-4 2-pin	90/91
012-037	13429603	DIN 8P CS0690-1-1	all but 90/91
009-036	. . .	DIN 6P CS-660-1-1	80/81/90/91

*Jacks are often called out by abbreviation. So are switches.
exp. HLJ-0264-01-030 --- LJ-264-1-3

SWITCH

. . .	13139131	SLE-623-12P(S) lever 80/81 single throw	
. . .	13139130	SLE-622-12P(S) lever 81 U/D throw	
001-214	13119401	SRM-1025172 rotary	10/12/40/50
001-272	13119702	SRM-1018112 rotary	82
001-183	13159304	SSB-02335 slide	10/12/40/50
001-182	13159103	SSB02242 slide	12/30/40/50/72
001-228	13159503	SQPR240120P slide	21/31 (abbr. SQPR24-12P)
001-177	13159302	SSA04301 slide	82
001-176	13159102	SSA04202 slide	82
001-049	13129901	DS-102 red push	40/82
001-215	13129101	SDG5P001-1 power	90/91 100V
001-216	13129102	SDG-5P001-2	90/91 117V
001-217	13129103	SDG5P502	90/91 220/240V

OLD NO. NEW NO. PART NAME MO

POTENTIOMETER

Slider

029-519	13339301	EVA-H04C15A15	100KA	10
029-521	13339305	EVA-H04C15A55	500KA	50
029-522	13339302	EVA-H04C15A16	1MA	50
029-531	13339304	EVA-H04C15B15	100KB	10
029-523	13339303	EVA-H04C15A26	2MA	40
029-543	13339401	EVA-TOAC15A15	100KA	10
029-555	13339402	EVA-TOAC15B15	100KB	10
029-570	13339403	EVA-TOAC15D16	1MD	40
029-571	13339404	EVA-TOAC15D26	2MD	40
029-022	. . .	PB-4 easy		81
		EVA-H 20mm stroke		
		EVA-T 30mm stroke		

Rotary

028-720	. . .	VM10RK15A26(L)	2MA	80
028-727	. . .	VM10RK15B15(L)	100KB	80
028-763	13219220	VM10RB100B15	100KB	10
028-762	13219219	VM10RB100B54	50KB	72
028-760	13219225	VM10RC38CB14	10KB	72
028-774	13219226	VM10RC38C015	100KC	72
028-749	13219222	VM10RC38CA14	10KA	72
028-756	13219221	VM10RC38CA26	2MA	72
028-755	13219223	VM10RC38CA16	1MA	82

*VM10RC38C/10RB10C shaft: K-20 (20mm length)
GM70R910B terminal: L shaped pin

028-664	13219806	GM70R910E	100KA/100KB	
028-665	13219807	GM70R910E	100KB	2

Trimmer

Carbon solid formerly named as "SR19R"

030-465	13299114	H1051A013	10KB	10
030-467	13299115	H1051A015	22KB	10
030-469	13299116	H1051A016	47KB	72
030-471	13299117	H1051A019	100KB	10

Metal glaze formerly named as "CR19R"

030-491	13299542	H1021A009	2.2KB	10
030-497	13299544	H1021A015	22KB	32
030-501	13299546	H1021A019	100KB	5

Tantalum thin film

030-625	13299501	PN822H101H	100B	10
030-630	13299504	PN822H202H	2KB	10
030-631	13299506	PN822H501H	500B	80
030-632	13299507	PN822H502H	5KB	10
030-636	13299508	PN822H503H	50KB	10

Zener diodes 182453, 182454

Application is thermal drift compensates identical electrical characteristics is provided with low temperature coefficient be a good replacement for 182453.

NAME	MODULE	OLD NO.	NEW NO.	PART NAME	MODULE		
SEMICONDUCTOR							
Transistor							
H04C15A15	100KA	10/12/21/30	017-010	15129801	2SD234-O	90/91	
H04C15A55	500KA	50	017-012	15119106	2SA733-Q	72/82	
H04C15A16	1MA	50	017-013	15129107	2SC945-Q	72/82	
H04C15B15	100KB	10/12/21/30/32/40/50	017-016	15139103	2SK30ATM-GR	FET	10/21/30/40/50/80/81/82
H04C15A26	2MA	40/50	017-016B	15139103A	*SK30ATM-GR selected on gm base	72	
TOAC15A15	100KA	10/21	017-022	15119800	2SB434-O	90/91	
TOAC15B15	100KB	10/21/31/32/40	017-039	15139110	MF510	10/12	
TOAC15D16	1MD	40	017-046	151291050A	2SC828R MZ selected	50	
TOAC15D26	2MD	40	017-105	15119112	2SA1015-Y	10/12/21/30/31/32/40/50/80/81	
assy		81	017-110	15129115	2SC1815-Y	10/12/21/30/31/40/50/80/81	
H 20mm stroke			017-124	15119108	2SA798-G	82	
T 30mm storke							
RK15A26(L)	2MA	80/81					
RK15B15(L)	100KB	80/81					
Diode							
RB10CB15	100KB	10/12/30/31/72	018-014	15019103	1S2473	except 90/91	
RB10CB54	50KB	72/82	018-015	15229908	SOT-1000 thermistor	10/21/82	
RC38CB14	10KB	72	018-061	15019210	1R5BZ61 100V 1.5A	90/91	
RC38CB15	100KB	72	018-078	15019625	1S2453	zener 6-7V 250mW @ 10mA	10/12
RC38CA14	10KA	72	018-079	15019627	1S2454	see below center	80/81
RC38CA26	2MA	72					
RC38CA16	1MA						
LED							
			019-020	15029109	GL-3AR-2 red	72/82	
					LR0601R red	90/91	
				* LR --	longer leads		
			019-022	15029110	GL-3AR-1 red	10/12/21/30/31/32/40/50	
			019-023	15029111	GL-3PG-1 green	10/21/30	
IC							
			020-001	15199502	TA-7066AP	31	
			020-024	15189189	uA301HC	10/31/80	
			020-032	15219101	uA726HC	10/12	
			020-040	15159104TO	TC4011BP	82	
			020-041	15159105TO	TC4013BP	31/72/82	
			020-063	15219203	ME3004	BBD	72
			020-026	15219106	LM1496E	50	
			020-096	15229803	BA662B	10/30/40/50	
			020-160	15229802	BA662A	10/21	
				*BA662A can replace BA662B			
			020-097	15189105	uPC4558C	all except 90/91	
			020-100	15189118	TL082CP	10/12/40/50/82	
			020-105	15189121	CA3140T	82/80/81	
			020-152	15189102	NJM4558DD	72	
			020-165	15219109	NE-555P	72	
			020-167	15159107ZO	MC14022B	82	
			020-194	15159102TO	TC40G10BP	82	
			020-228	15199110TO	TA7179M	90/91	
			. . .	15189131	LP1374E	80/81	

see 1S2453, 1S2454

thermal drift compensation. Although al electrical characteristics, 1S2454 low temperature coefficient and can ment for 1S2453.